JAVAD®
NAVIGATION SYSTEMS

PC-CDU
User's Manual

Reflects PC-CDU Version 2.1.10 MS (Build: April 1, 2002)
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List of abbreviations, acronyms and other notation used in this manual

ARP – Antenna Reference Point

CMR – A format used to transmit differential corrections and related data from the Base receiver to the Rover receiver in DGPS and RTK applications

C/A – Coarse Acquisition code

DGPS – Differential GPS

DLL – Delay Lock Loop

DNS – Domain Name System

GUI – Graphical User Interface

IP – Internet protocol

LO – Local Oscillator

MINTER – Minimum INTERface. A dedicated user interface designed for JNS receivers

NS – Navigation Satellite

P – Precise code

PC – Personal Computer

PLL – (Carrier) Phase Lock Loop

PLLC – (Carrier) Phase Lock Loop Control

PS – Pseudorandom Sequence

Receiver – Satellite Navigation User Receiver developed and manufactured by JNS

RMS – Root-mean-square

RNSS – Radio Navigational Satellite System

RTCM – (Radio Technical Commission for Maritime Services). This format is used to transmit differential corrections and related data from the Base receiver to the Rover receiver in DGPS and RTK applications

RTK – Real-time kinematic

SW – software

VCO – Voltage Control Oscillator

1. PC-CDU software

1.1. PC-CDU's purposes and functions

PC-CDU is a windows application for controlling radio navigation receivers developed and manufactured by the Javad Navigation Systems company.

The most current version of PC-CDU MS (as of 2.1.10, April 1, 2002) provides the following functions:

- Connects a PC to a JNS receiver via the computer's serial or parallel ports (*Direct Connection Mode*).
- Configures a JNS receiver as an "Internet Server". To do this, the user must run PC-CDU in *Internet Server Mode*.
- Connects a PC to a JNS receiver that has been configured and is being run in *Server Mode* via the Internet. In this case the user must run his/her PC-CDU in *Internet Client Mode*.
- Keeps track of the total number and the status of all visible satellites.
- Displays the receiver's current position and time in real time.
- Controls the recording of raw data measurements into the receiver's internal memory.
- Downloads collected raw data measurements (log-files) from the receiver's internal memory onto the computer's disk drives.
- Records, in real time, the receiver's raw data measurements on the computer's disk in JPS and RINEX formats (using the executable file **jps2rinex.exe**).
- Displays, in real time, the graph of the receiver's current position and the satellite sky plot.
- Allows displaying and programming the receiver's main settings (such as *Data Recording Interval*, *Position Computation Mode*, etc.).
- Allows display of the current receiver options and loading of *Option Authorization Files*.

1.2. Typographic conventions

Table 1 specifies all typographic conventions used in this manual.

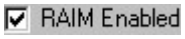
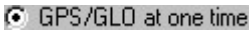
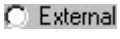
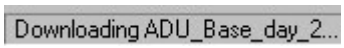
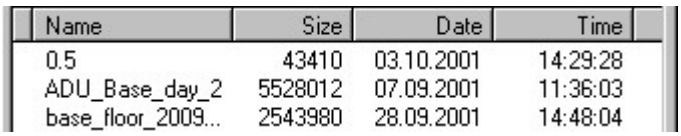
Table 1. Document conventions

Example	Description
Clock offset	This format is used in definitions or when it is necessary to emphasize that the marked term is technical jargon.
Select from the **File**... menu	Titles of dialog windows/boxes, names of menu options and other GUI components.
Press **CTRL+V**	This format is used to specify keys and key combinations.
Type the string **194.85.135.59**.	This format is used to enter various string information (e.g. file and directory names) as well as user commands.
To clear the NVRAM: 1. Select the option **Clear NVRAM** from the **Tools** menu...	This format is used to describe the sequence of steps that the user must take
Note...	The user is recommended to take note of the given information.
Some good hints...	These hints and tips will help the user learn the program faster.
Caution! By no means use...	The user is warned about possible errors.

1.3. Terminology and notation

Table 2 shows what terminology and notation are used for standard Windows GUI components in this manual.

Table 2. Terms used in this manual to describe standard Windows GUI components

GUI component	Term
	Button
	Edit box or indicator
	Selected checkbox
	Unselected checkbox
	Selected radio button
	Unselected radio button
	Progress bar
	Status bar
	Spin button
	File List box
	Drop-down list box
	Menu
	Tab Control

1.4. What information can be found in this document?

This document provides all information necessary for the user to comprehensively learn PC-CDU before installing and using this software.

In Chapter 2, the reader will find detailed instructions about how to install PC-CDU on a PC.

Chapter 3 describes the main components of PC-CDU's graphical user interface and explains how to launch the program.

Chapter 4, which is intended as a *user's reference manual*, focuses on the particular functions this program features.

The appendixes provide supplementary information about PC-CDU:

Appendix A. PC-CDU Scripts introduces readers to the scripts and describes how to use them.

Appendix B. Output Period Setup Wizard presents the windows, which are used to adjust the periods of generating raw data and position.

Appendix C. Channel Navigation status codes shows the list of all available satellite navigation status codes.

1.5. System requirements

Check that you have the following required (or recommended) items before installing and using PC-CDU.

- PC-compatible with Intel® Pentium® 100 MHz or faster.
- 5 Mbyte free disk space.
- 16 Mbyte RAM or more (32 Mbyte recommended).
- 32-bit operating system such as MS Windows 95/98/Me/NT/2000.
- Color monitor at 640x480 screen resolution.
- Internet Server/Client applications require that your computer has an internet connection.

If run on a Windows NT/2000 computer, PC-CDU does not allow connection to the receiver via the computer's parallel ports.

1.6. Full- and limited-functionality versions of PC-CDU

PC-CDU exists in two implementations: the full-functionality version called **PC-CDU MS**, and the reduced-functionality version called **PC-CDU Lite**. Differences between **PC-CDU MS** and **PC-CDU Lite** are listed in Table 3.

Table 3. Differences between PC-CDU MS and PC-CDU Lite

Function	PC-CDU MS	PC-CDU Lite
Connect to a receiver via the Internet	Yes	No
Record data on a PC's disk drive in real time ("Real-Time Data Logging")	Yes	No
Graphical presentation of the receiver's current position & the satellite sky plot	Yes	No

Each version of **PC-CDU MS** has a limited lifetime as a full-functionality tool. After the current version of **PC-CDU MS** expires, its extended functions (see Table 2) are automatically disabled so that **PC-CDU MS** "turns into" **PC-CDU Lite**.

1.7. Technical Support

Occasionally, PC-CDU users encounter problems during installation or use of the program.

Should you have any problems with PC-CDU, please contact JNS Customer Support.

Please be ready to provide JNS Customer Support with the following information:

- Did you try to fix the problem(s) on your own based on the troubleshooting tips available in the manual?
- System/hardware specifications of the computer on which you are running (installing) your PC-CDU.
- ASCII file with a complete list of the receiver options/receiver parameters enabled in your receiver.

For how to obtain a text file listing all receiver options and parameters, please refer to 4.2.16.

To get in contact with JNS Customer Support, please use the following e-mail addresses:

pccdu@javad.com or support@javad.com.

2. Setting up PC-CDU

2.1. Installing PC-CDU

There is no special installer for the current version of PC-CDU. This tool is a ready-to-run executable.

To install PC-CDU on you computer, take the following steps:

1. Visit the JNS section (**http://www.javadgps.com/**) of the Javad website page. Click on the *Support* link in the top-left corner of the window. Next, select the *Software Updates* link. Finally, click on the link **Click here to download pccdu_ms.zip** to start data downloading.

To download PC-CDU Lite, select the **Free Software** link on the **Support** page.

2. The **File Download** dialog box will be opened. To continue the download process, press **Save** (Figure 1).

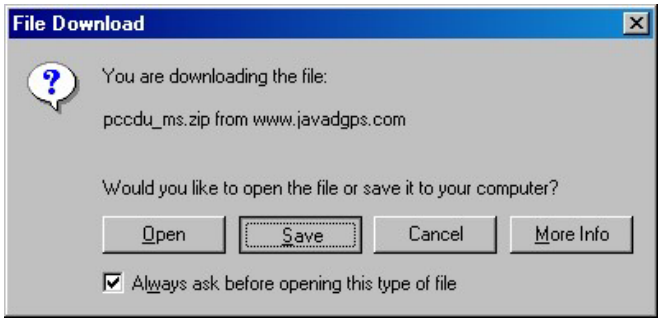

File Download
You are downloading the file:
pccdu_ms.zip from www.javadgps.com
Would you like to open the file or save it to your computer?
Open
Save
Cancel
More Info
Always ask before opening this type of file

Figure 1. Dialog box "File Download"

3. Use the dialog window **Save As** to specify the desired destination (disk drive/folder) for the archive **pccdu_ms.zip** (Figure 2).

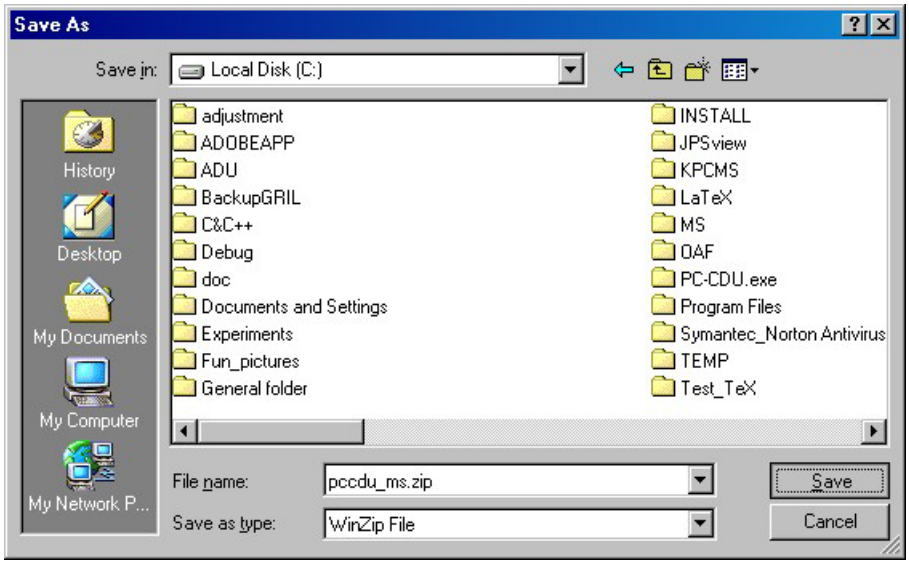


Figure 2. Select a destination for the archive pccdu_ms.zip

4. Wait while the archive is being downloaded onto your system (Figure 3).

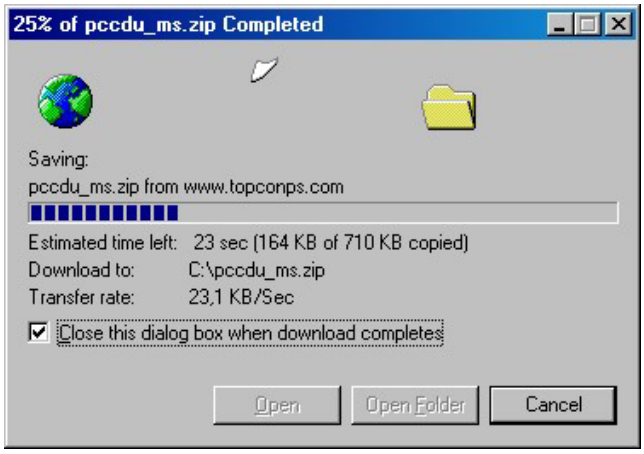


Figure 3. Copying data from the website to your computer's disk drive.

5. Create a folder on your local disk drive[1].

6. Unpack the archive into this folder with WinZip® or another appropriate software.

You will see the following files appear in the folder:

- Executable file **Pccdu.exe;**
- Auxiliary binary file **Iptaccess.vxd.**

[1]) It is recommended to use `C:\Program Files\JNS\PC-CDU`

2.2. Removing PC-CDU

The simplest way to remove PC-CDU from your system is to delete the whole directory[2] which you created when installing PC-CDU and in which **Pccdu.exe** and other PC-CDU related files reside. Also, do not forget to delete the PC-CDU shortcut, if available.

[2]) Assuming this directory is not used for storing any other (i.e. PC-CDU-unrelated) data.

3. Starting PC-CDU

3.1. How to start up PC-CDU

PC-CDU can be launched, as any other windows program, in one of the following ways:

WAY # 1.

Double-click on PC-CDU's shortcut on the desktop (if it has been created).

WAY # 2.

In Windows Explorer go to the directory where **Pccdu.exe** resides and double-click on the corresponding icon.

WAY # 3.

Press the **Start** button in the bottom-left corner of your computer's screen and select **Run** from the pull-up menu. In the **Open** box specifies the full path to **Pccdu.exe**. Press **Ok**.

After you first run PC-CDU, you will see the file **pccdu.ini** appear in the directory from which the executable has been launched. In this .INI file PC-CDU will store all its settings.

If you want to have more than one copy of PC-CDU, each one with its own unique settings, you will probably need to keep these copies in *different* directories. Running different copies of PC-CDU from different directories will allow you to maintain unique setting for each of the copies.

Once PC-CDU is launched, the **Connection Parameters** window will appear (Figure 4). In this window the user first selects the desired *connection mode*:

- **Direct**
- **Internet Client**
- **Internet Server**

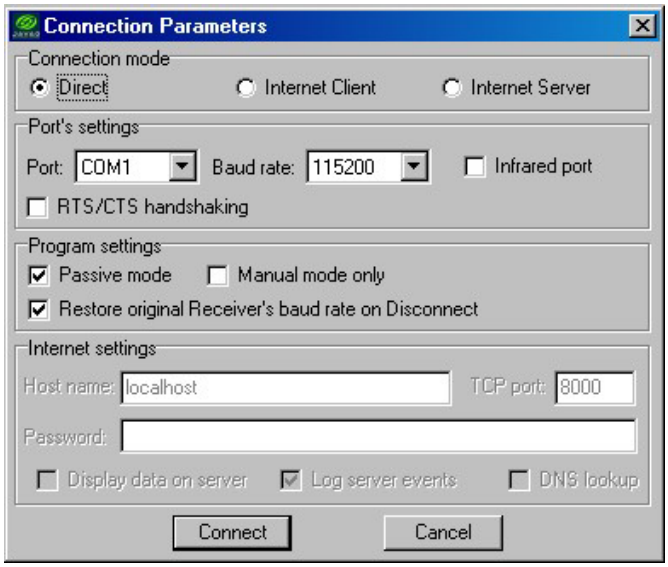


Figure 4. "Connection Parameters" dialog

3.1.1. Direct Mode

This mode is used when it is required to connect a computer and a JNS receiver *directly*, i.e. using the computer's serial or parallel port and an appropriate cable (see Figure 4)

To connect your computer to the receiver in Direct mode:

1. Select from the **Port** list box the serial (COM1, COM2, ...) or parallel (LPT1, ...) port that you want to use for connection.
2. From the **Baud Rate** list box select the desired baud rate.

The checkbox **Infrared port** is selected when you want to use an infrared adaptor to establish a connection between your computer and receiver over an infrared data-link.

Connection via an infrared port will be available only if the following conditions are met:

- An appropriate external infrared adaptor is connected to the selected serial port on the computer side.
- Your receiver supports the infrared port hardware-wise.
- The option **Infrared Port** is enabled in your receiver.

3. Select the **RTS/CTS handshaking** checkbox (optionally).

It is strongly recommended that you select the RTS/CTS checkbox as this makes data exchange between the receiver and computer more reliable. Prior to selecting this option, make sure that:

- RTS/CTS handshaking is supported both at the computer and at the receiver.

- The cable used allows RTS/CTS handshaking.

4. Press **Connect**.

Along with the above listed options the user may need to adjust some of the settings in the **Program Settings** panel. This panel includes the following three options:

- **Passive mode**
- **Manual mode only**
- **Restore the receiver's original baud rate on Disconnect**

In **Passive mode**, PC-CDU is not allowed to change any receiver parameters. Note that in this mode PC-CDU will display in the main window only those satellites whose elevation angles are larger than the elevation mask specified by the parameter **Terminal Elevation Mask** (see 4.2.4.1). Once **Passive mode** is off, PC-CDU will automatically force **Terminal Elevation Mask** to -90º. Therefore the user will be able to view in PC-CDU's main window (see 4.1) all of the satellites that are being tracked. It is important to remember that this setting (-90º) will be effective as long as the main window remains open. Note however that the original value of **Terminal Elevation Mask** will not be lost in this case: once the main window is closed, PC-CDU will automatically restore the original mask.

If **Manual mode only** is on, PC-CDU will perform as an input/output terminal, which allows the user to send commands to and receive information from the receiver.

If the user has selected the checkbox **Restore the receiver's original baud rate on Disconnect**, PC-CDU will determine and save the receiver's original baud rate and then restore this setting automatically on disconnecting the receiver (by pressing the **Disconnect** menu item).

3.1.2. 'Internet Server' Mode

When running PC-CDU in **Internet Server** mode, the user can configure a JNS receiver[3] to perform as a *PC-CDU server*. Remote receivers (PC-CDU clients) can then access this PC-CDU-server via the Internet[4].

The parameters **Port**, **Baud rate**, **Infrared port**, **RTS/CTS handshaking**, **Passive mode** and **Manual mode** serve the same purposes as in **Direct** mode (see 3.1.1). The other group of parameters, **Internet Settings**, are intended for the user to correctly tune PC-CDU for Internet connection: **TCP port**, **Password**, **Log server events**, **Display data on server** and **DNS lookup**.

Special attention should be given to setting **TCP port** for PC-CDU servers[5]. Make sure that the selected TCP port does not coincide with any one of the reserved port numbers. The default TCP port number is 8000.

The edit box **Password** is used to protect the PC-CDU server from unauthorized access. The user can enter in this edit box up to 128 alphanumeric characters.

---

[3] It is assumed that the receiver is connected to your computer directly.

[4]) This version allows a JNS receiver configured as PC-CDU-server to be accessed by only one remote receiver (PC-CDU-client) at a time.

[5]) According to TCP specifications, TCP port number can be up to 64K. Although the user can formally enter a port number N, which is greater or equal to 64K, the software will implicitly force it to *N mod 64K.*

If the user has selected the checkbox **Log server events**, there will be created a text log-file (**pccdu_server.log**) in PC-CDU's working directory. This file will contain all the information that has been collected during the communication session between the PC-CDU server and PC-CDU client. New information will be added to the file after another client connects to the PC-CDU server.

If the user wants to view the satellite information and the antenna's current position in the main windows, he/she must select the **Display data on server** checkbox. Otherwise no information will be displayed in the window.

If the checkbox **DNS lookup** is selected, the file **pccdu_server.log** will contain the IP and DNS addresses.

Figure 5. shows an example of the **Connection Parameters** dialog window in **Internet Server** mode.

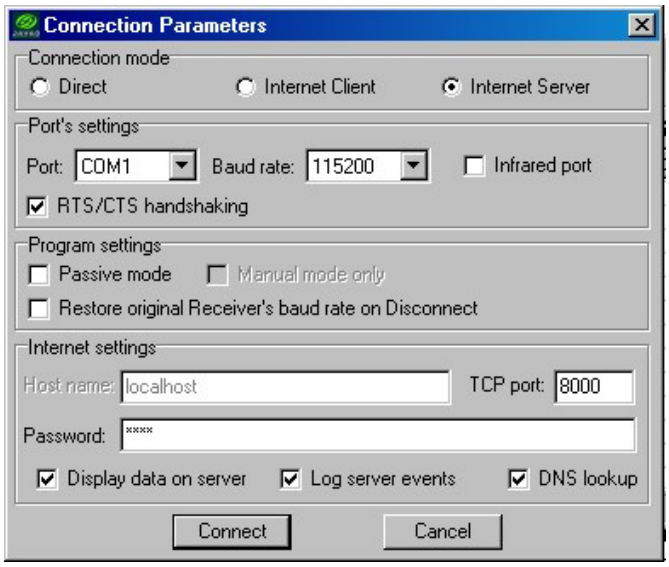


Figure 5. "Connection Parameters" window in Internet Server mode

In this example a four-character password and the default TCP port number are used.

After the **Connect** button is pressed, the dialog windows **Chat** and **Main** will be displayed. The **Chat** window allows an operator running **PC-CDU Client** to communicate with his/her counterpart who runs the corresponding remote receiver with **PC-CDU Server**. In addition, this dialog window displays information on the server's current status.

3.1.3. 'Internet Client' Mode

The user selects **Internet Client** mode when it is required to access a remote receiver that is directly connected with and controlled by a computer on which **PC-CDU Server** is being run (the obvious pre-condition is that both computers must have access to the Internet.).

After a connection to the remote receiver is established, the user can control this receiver exactly in the same manner as if the user's computer were directly connected to the receiver, specifically: send commands to the remote receiver, download log-files from the receiver's memory, etc. In order to be able to connect to the remote receiver, the user first needs to con-

figure his/her computer as a *PC-CDU Client* capable of working with the corresponding *PC-CDU Server*.

The user is required to know the following information about the *PC-CDU Server*:

- IP or DNS address;
- TCP port number;
- password (if necessary).

Figure 6. shows an example of the **Connection Parameters** dialog window with the following settings:

- PC-CDU Server's IP address: **194.85.135.59**;
- TCP port number: **8000**;
- Password is not used.

In the **Host name** edit box the user can enter either the server's IP address (it is **194.85.135.59** in the given example) or its DNS address (it is **pab.javad.com** in this case).

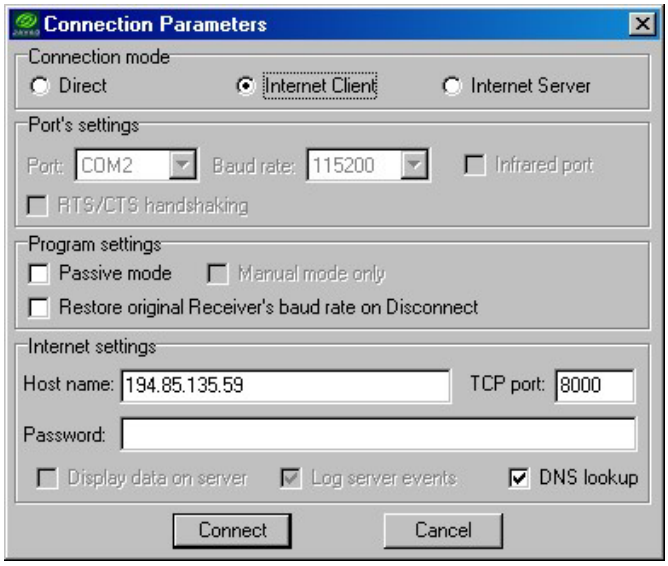


Figure 6. "Connection Parameters" window in Internet Client mode

After all necessary settings are made to this window, press **Connect**. You will see PC-CDU open the main window and the **Chat** window.

The **Chat** window allows the operator running PC-CDU-Server on one end to exchange messages with the operator running PC-CDU-Client on the other end (Figure 7). Messages sent from the client to the server are preceded by the character ">". Messages sent by the server to the client begin with the character "<". The last received message is topmost in the list.

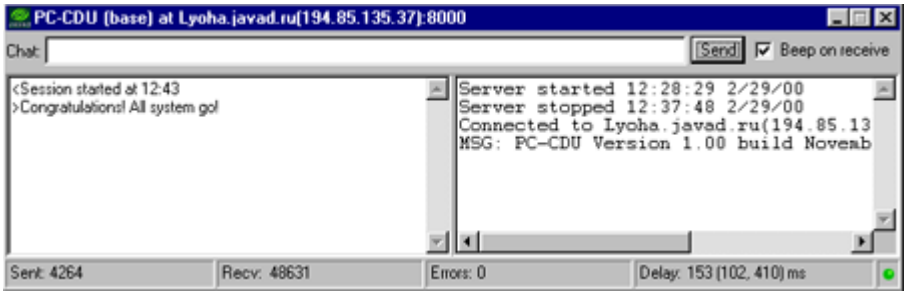


Figure 7. "Chat" window

3.2. How to close PC-CDU

To disconnect from the receiver, select the **Disconnect** option from the **File** menu. Alternatively, you can use the keys **CTRL+D** to close the connection.

Pressing the **Disconnect** button will result in:

- Turning off **RTS/CTS handshaking**;
- Resetting the receiver parameter **/par/out/elm/cur/term** to its original value. Only if the checkbox **Passive mode** has not been deselected;
- Resetting the baud rate to 115200, if the receiver's original baud rate exceeded 115200;
- Restoring the original baud rate (i.e. that the receiver had before running PC-CDU). Only if the option **Restore the receiver's original baud rate on Disconnect** has been selected.

To quit PC-CDU, select **Exit** from the **File** menu. Alternatively, you can close the program by pressing the keys **CTRL+X.** If the receiver has not been disconnected by the time you turn the program off, the connection will be automatically broken before PC-CDU is closed.

It is strongly recommended to close the connection with the receiver and close PC-CDU prior to switching the receiver **OFF** and disconnecting the cable.

4. Learning PC-CDU in detail

4.1. Main window

After PC-CDU has established a connection between the computer and receiver, the main window will be opened (see Figure 8). This window displays the antenna's current position (if available) and the basic tracking information (parameters) for the locked satellites. These tracking parameters are described in Table 4. The main window consists of two panels, the **GPS Satellites** panel on the left and the **GLONASS Satellites** on the right, which are separated by **Geo | XYZ | Target** box.

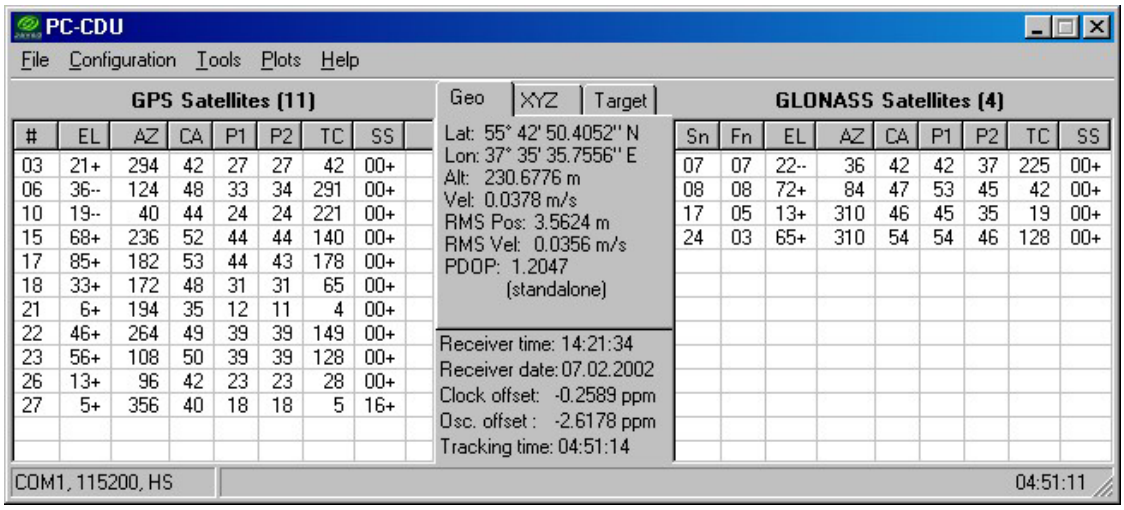


Figure 8. Main window

Table 4. Tracking parameters displayed in the GPS Satellites and GLONASS Satellites panels

Parameter	Description
#	GPS SV PRN. If the character "*" is shown next to PRN in the column, this means that almanac data are unavailable for the corresponding satellite.
Sn	GLONASS SV Orbital Slot Number. If the character "*" is shown next to Sn in the column, this means that almanac data are unavailable for the corresponding satellite.
Fn	GLONASS SV Frequency Number.
EL	Elevation angle in degrees. The signs "+" and "-" immediately following the elevation angles indicate that the corresponding satellites are ascending and descending, respectively. If a satellite is at apogee, it is marked with "^".
AZ	Azimuth in degrees
CA	Signal-to-noise ratio (C/N0) in the C/A channel [dB*Hz]
P1	Signal-to-noise ratio (C/N0) in the P1 channel [dB*Hz]
P2	Signal-to-noise ratio (C/N0) in the P2 channel [dB*Hz]
TC	Time elapsed since the last loss-of-lock in the C/A channel for the corresponding satellite. This time is given in minutes or, if the symbol ":" is specified in the column, in seconds.
SS	Satellite navigation status. For a complete description of the satellite navigation status structure, see Appendix C. If a satellite is not used in position computation, its SS flag will be set to "-". Otherwise "+" will be displayed.

Note that "??" will be displayed everywhere in the panels where the corresponding parameters are unavailable.

The user can sort data in a column in descending (ascending) order by clicking on the column's title.

4.1.1. Geo tab

The **Geo** tab shows the receiver's antenna's current position and the time-frequency parameters describing the behavior of the receiver's local oscillator (Figure 9):

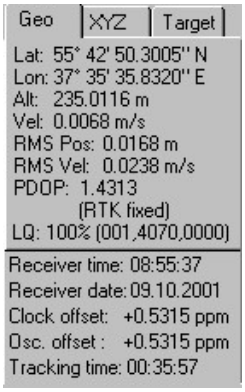


Figure 9. "Geo" tab

- Geodetic coordinates[6]
  - Lat – latitude;
  - Lon – longitude;
  - Alt – ellipsoidal height.
- Vel – (magnitude of the) velocity (m/s).
- RMS Pos – rms position error[7] (m).
- RMS Vel – rms velocity error[8] (m/s).
- PDOP – Position dilution of precision.
- Solution type:
  - Standalone
  - Code differential
  - RTK float
  - RTK fixed
- **LQ** – This field reflects the status of the received differential messages and contains the following information:
  - Data link quality in percentage.
  - Time (in seconds) elapsed since the last received message.

---

[6]) These geodetic coordinates are computed in WGS 84 regardless of the current value of `/par/pos/datum/cur`.

[7]) More precisely, this is the square root of the trace of the *position error* variance-covariance matrix.

[8]) More precisely, this is the square root of the trace of the *velocity error* variance-covariance matrix.

- Total number of received *correct* messages.
- Total number of received *corrupt* messages.

If the receiver is not (for some reason) receiving differential corrections or if none of the ports has been configured to receive differential corrections, the field **LQ** will either be empty or it will look like this: **100%(999,0000,0000)**. Currently the values for this filed are obtained from the [MS] message.

- **Receiver time** shows the receiver's current *time within day*. This value is taken from the message [~~]. For more information about [~~], see the GRIL Reference Manual.

Currently the message [~~] reports the *time within day* in the GPS time scale only.

- **Receiver date** shows the receiver's current date as specified in the corresponding [RD] message.
- **Clock offset** describes the time derivative of ($T_r - T_{rr}$), where Tr designates the receiver time, T_{rr} designates the receiver reference time. For more information about T_r and T_{rr}, see the GRIL Reference Manual. This parameter is obtained from the [DO] message and is expressed in ppm.
- **Osc. offset** is derived from the message [OO] and it is expressed in ppm. The parameter describes the difference between the VCO's nominal and quiescent frequencies.
- **Tracking time** is the time elapsed since the last *complete* loss-of-lock event in the receiver's C/A channels as specified in the corresponding [TT] message.

4.1.2. XYZ tab

The **XYZ** tab, which is shown in Figure 10, is similar to the **Geo** tab except for the fact that the position of the receiver's antenna is displayed in Cartesian coordinates here.

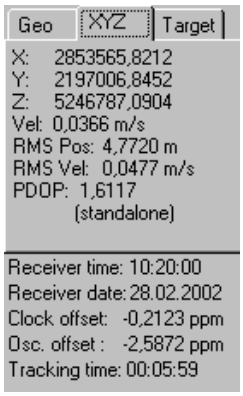


Figure 10. "XYZ" tab

4.1.3. Target tab

The **Target** tab (Figure 11) is used to display various navigational information, specifically:

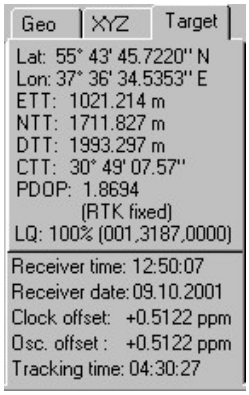


Figure 11. "Target" tab

- Lat, Lon –latitude/longitude of the target or of the receiver's antenna.
- ETT, NTT – 'Easting-to-target' and 'Northing-to-target' in the local system with the origin at the receiver.
- DTT – 'Distance-to-target' (in meters).
- CTT – 'Course-to-target'.

The rest of the parameters have been described above (see the **Geo** and **XYZ** tabs).

To set the target coordinates equal to the current receiver coordinates, double-click on either **Lat** or **Lon** field.

To reset the timer in the bottom-right corner of the **Main Window** to 00:00:00, double-click somewhere in the *hour:min:second* area.

4.2. The Main window's menu

The user can access any one of PC-CDU's dialog windows by selecting the corresponding item from the main window's menu (Figure 12). Some of the menu items have shortcut keys.

For example, the user can select the **Site** item (from the **Configuration** menu) with the keys **CTRL+I.**

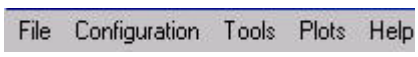


Figure 12. The Main window's menu

The following sections will describe all available menu items and the corresponding dialog windows in detail.

4.2.1. 'File Manager' window

To open the **File Manager** dialog window, select the **File Manager** item from the **File** menu, or press the keys **CTRL+F**.

The **File Manager** dialog window has three tabs:

- **Download files**
- **Current log files**
- **Download path**

4.2.1.1. Download files

This dialog window (Figure 13) allows you to delete log-files from the receiver memory, or download them onto your computer.

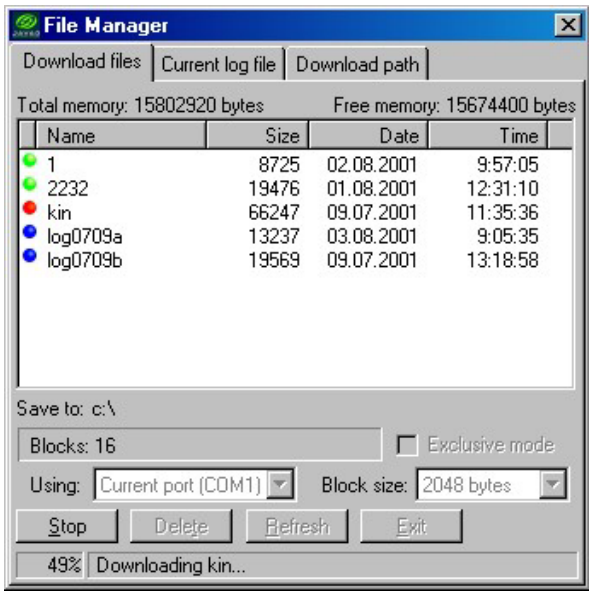


Figure 13. "Download files" tab

Before downloading the desired log-file(s) onto your computer, select the folder on PC where you want the file(s) to be stored. To do this, use the **Download path** tab.

Once the destination has been specified, go to the **Download files** tab, highlight the file(s) that you want to download onto the computer, and press **Download**.

You will see the following color *download status* indicators in the course of downloading the data (see Figure 13):

- The green circle (●) indicates the file(s) that have been successfully downloaded.
- The red circle (●) marks the file that is being downloaded.
- The blue circle (●) indicates the file(s) standing in queue for downloading.

You can interrupt the download by pressing the **Stop** button.

Files in the destination folder will have the same names and extensions as the original receiver log-files. Before downloading the current log-file in the destination folder, PC-CDU will check if there already exists a file with the same name in this folder. If such a file is found there, you will be prompted to select either **Append** or **Overwrite**. In the first case the log-file

downloaded will be appended to the existing file. In the second case the existing file will be overwritten (Figure 14).

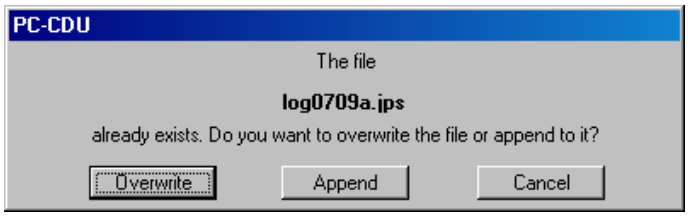


Figure 14. Message notifying that a file with the same name already exists

Care should be taken when selecting **Append**. This option is normally used only if the downloading process has for some reason been interrupted and you want it to be resumed.

The warning '**Last warning: Waiting for the 1st block**' appearing in the status bar while downloading a log-file (Figure 15) indicates that PC-CDU cannot for some reason retrieve the next block of data from the receiver. The field **Retries** shows how many attempts to retrieve this block of data have been made so far.

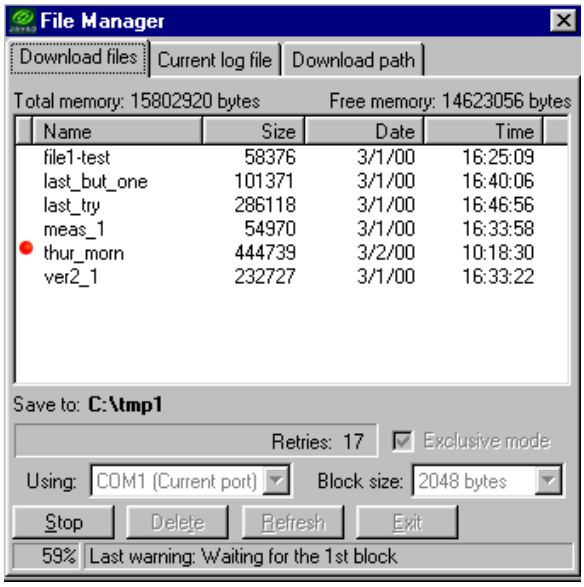


Figure 15. Message notifying that a problem occurred while retrieving the current block of data from the receiver

If such a problem occurs, you may need to try a higher baud rate or/and a smaller block size.

Usually, the larger the block size the more efficient the data transfer. On the other hand, if the connection between the computer and receiver is not reliable enough, reducing the block size can often help to exclude or at least minimize communication errors.

Receiver data can also be transferred to the computer via the parallel port, which normally allows a fifteen to twenty-fold reduction of the data transfer time as compared to the serial ports. There are however three (3) limitations due to which you will not be able to use the parallel ports for data transfer even if such ports are available both in the receiver and the computer.

The first limitation is the requirement that your computer runs under Windows 95, 98 or ME. The second limitation is that your computer's parallel port must be configured as ECP or ECP+EPP.

The third limitation is that the option **Parallel Port** must have been enabled in your receiver.

Selecting the **Exclusive mode** checkbox will allow you to considerably increase the data transfer speed, especially if 115200 or a higher baud rate has been set. Note however that using this option will disable most of the processes running inside the receiver (including the satellite tracking process) in order to ensure the highest possible file transfer speed.

One more note about downloading the receiver log-files onto the computer. If the **Exclusive mode** checkbox is not selected, you can start downloading the current log-file without closing it first. The downloading process will stop at the moment when EOF is reached in the log-file but the receiver will however keep on writing new data to the log-file after that.

This method has two drawbacks. First, the download progress indicator can occasionally display values exceeding 100%. Second, the last record can be corrupt in the downloaded file. If **Exclusive mode** is on, it is impossible to start downloading the current log-file without closing it first. In other words, if the **Exclusive mode** checkbox has been checked and you want to start downloading the current log-file, PC-CDU will automatically close the log-file after the download is finished.

Use the **Delete** button to delete unnecessary log-files in the receiver memory.

To delete a group of log-files, click on any one of them, then hold down the [**CTRL**] key and select the rest of the files, and finally press the **Delete** button.

To delete a group of adjacent log-files, click on the first of them, then hold down the [**SHIFT**] key and click on the last of the files, and finally press the **Delete** button.

Log-files that have inadvertently been deleted from the receiver memory can be restored with the command **set,/par/dev/blk/a/removed,on**. You can send this command to the receiver from the **Manual Mode** dialog window. You are able to recover deleted files only if you haven't recorded any new files in the receiver memory since these files were removed. Otherwise, we cannot guarantee that the deleted files can be successfully restored.

With the **Refresh** button you can refresh the list of the receiver log-files.

Press **Exit** to close the **File Manager** tab.

4.2.1.2. The 'Current log file' tab

In this tab you can delete existing and create new receiver log-files (Figure 16).

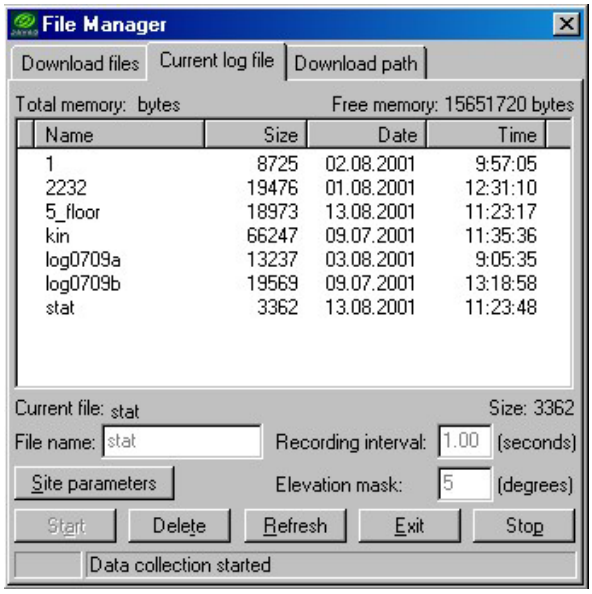


Figure 16. "Current log file" tab

To create (open) a new log-file take these steps:

1. Enter the desired filename in the '**File name**' edit box, or select a file from the file list displayed in this window. In the latter case, just double-click on the corresponding filename.
2. Specify the desired data recording interval (a.k.a. "data update interval") in the **Recording interval** edit box.
3. Set the desired **Elevation mask**.
4. Click the **Site parameters** button. The **Site Configuration** dialog box will appear (Figure 17). Specify the desired **Site Name** and then select the correct **Antenna Status** from the corresponding list box. Set the **Antenna Height** parameter and select/deselect the **Slant** checkbox depending on whether you have specified the slant or vertical antenna height. Set the correct **Antenna Type**. Press **OK**.

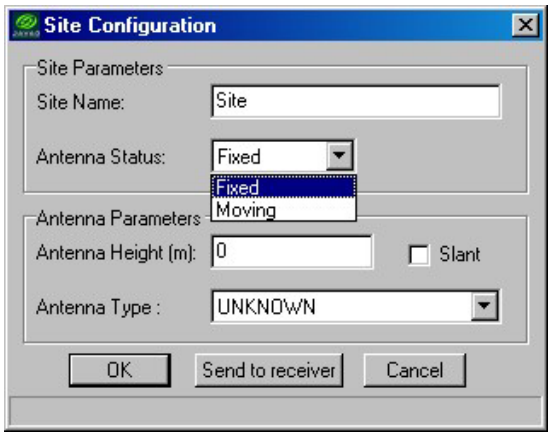


Figure 17. "Site Configuration" dialog box

After the **OK** button is pressed, the **Site parameters** dialog box will be closed and the parameters that have been specified in the box will be copied to **PCCDU.ini**. If you then press the **Start** button in the **File Manager** dialog window, these settings will be enabled and put in the newly created (current) log-file.

On the other hand, if you need to update the site information for the current log-file, it will be sufficient to press the **Send to receiver** button to send the new site settings (site name, antenna status, antenna height, etc.) directly to both the receiver/log-file and **PCCDU.ini**.

5. Press **Start**. A new log-file will be created[9] and the receiver will start recording data into the file.

If you set a recording interval that is not supported by the receiver, PC-CDU will launch a utility called **Output Period Setup Wizard**. For more information on the Wizard, see Appendix B. Output Period Setup Wizard.

To stop data recording and close the file, press the **Stop** button.

To keep track of the data recording process, see how the log-file size varies in time.

The field **Total memory** shows the total amount of space in bytes (in the receiver) available for data.

The field **Free memory** displays how much space in the receiver is free for storing data.

The buttons **Delete**, **Refresh** and **Exit** serve the same purposes as in the **Download files tab** (see 4.2.1.1).

[9]) According to the GRIL terminology, this file is referred to as “current log-file”.

4.2.1.3. 'Download path' tab

In this tab you select the destination folder for the files downloaded (Figure 18).

Figure 18. "Download path" tab

Note that the window's right-hand panel is for your reference only. You will be prevented from doing any operations on the files in the corresponding directory. If the user has not explicitly selected a destination folder for the files downloaded, these files will be stored based on the last specified download path.

4.2.2. 'Real-Time Logging' dialog window

The term *real-time logging* means recording receiver data into a PC in real time mode.

To open the **Real-Time Logging** dialog window, select **Real-Time Logging** from the **File** menu or press the keys **CTRL+R**.

The **Real-Time Logging** dialog boxes (see Figure 19 and Figure 20) are, structurally, similar to the **Main** window. For a description of the GUI components that are identical for the **Real-Time Logging** and **Main** windows, refer to 4.1. Below we will focus on the components specific to the **Real-Time Logging** dialog boxes.

Note the three tabs in the top-left corner of the window: **Single file**, **Multiple files** and **Select output path**. For information on the **Select output path** tab, refer to 4.2.1.3.

Before we get down to the other two tabs, let us consider the parameters displayed in the middle of the **Real-Time Logging** window, between the **GPS Satellites** and **GLONASS Satellites** tables.

The **Elapsed time** field shows the time elapsed since the current log-file was opened. Every time a new log-file is created, this timer is reset to 00:00:00.

The **Received** field shows the log-file size in bytes. This parameter will vary as new data is recorded into the file. After pressing the **Stop** button, you will see the log-file's final size in the field.

The **Start** button allows the user to start recording data into the file. After starting the data recording the name on the button will change to **Stop**. Pressing the **Stop** button will close the file.

If you set a recording interval that is not supported by the receiver, PC-CDU launches a utility called **Output Period Setup Wizard**. For more information on the Wizard, see Appendix B. Output Period Setup Wizard.

Press **Exit** to quit the **Real-Time Logging** dialog window.

The value of **Recording interval** specified in the **Real-Time Logging** window applies only to this mode. The **Elevation mask** edit box is associated with the receiver parameter **/par/out/elm/cur/term**.

4.2.2.1. 'Single file' tab

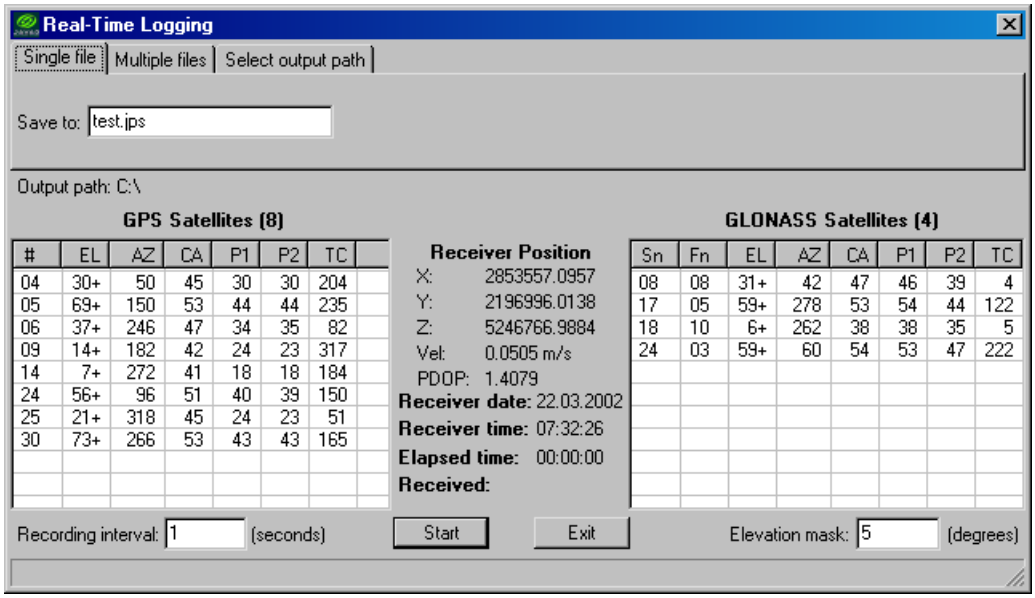


Figure 19. "Real-Time Logging" dialog window

In this mode (Figure 19) PC-CDU will record receiver data into one specific file on your computer.

In the **Save to** edit box enter the name of the file where you want the receiver data to be logged.

By default the name of a JPS file created in real-time logging mode will coincide with the site name from the **Site Configuration** dialog box.

4.2.2.2. 'Multiple files' tab

This function, "real-time logging of multiple log-files", is intended to automate the process of real-time downloading of the receiver data to JPS files according to the specified time schedule.

In this mode PC-CDU will automatically open/close JPS files in regular time intervals (Figure 20). A new JPS file will be opened immediately after the previous file is closed.

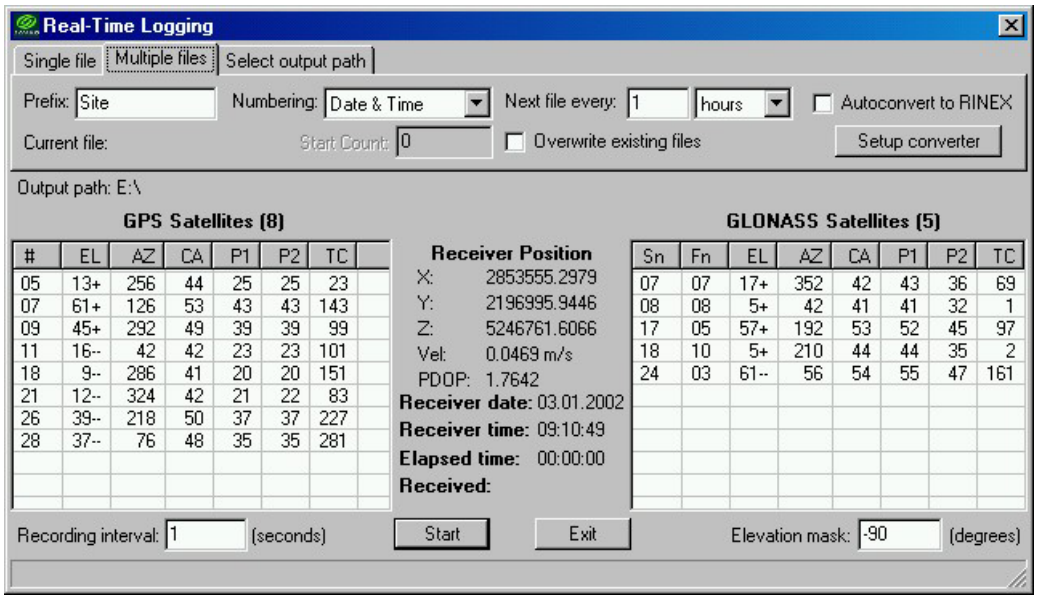

Real-Time Logging
Single file
Multiple files
Select output path
Prefix: Site
Numbering: Date & Time
Next file every: 1 hours
Autoconvert to RINEX
Current file:
Start Count: 0
Overwrite existing files
Setup converter
Output path: E:\
GPS Satellites (8)
EL AZ CA P1 P2 TC
05 13+ 256 44 25 25 23
07 61+ 126 53 43 43 143
09 45+ 292 49 39 39 99
11 16-- 42 42 23 23 101
18 9-- 286 41 20 20 151
21 12-- 324 42 21 22 83
26 39-- 218 50 37 37 227
28 37-- 76 48 35 35 281
Receiver Position
X: 2853555.2979
Y: 2196995.9446
Z: 5246761.6066
Vel: 0.0469 m/s
PDOP: 1.7642
Receiver date: 03.01.2002
Receiver time: 09:10:49
Elapsed time: 00:00:00
Received:
GLONASS Satellites (5)
Sn Fn EL AZ CA P1 P2 TC
07 07 17+ 352 42 43 36 69
08 08 5+ 42 41 41 32 1
17 05 57+ 192 53 52 45 97
18 10 5+ 210 44 44 35 2
24 03 61-- 56 54 55 47 161
Recording interval: 1 (seconds)
Start
Exit
Elevation mask: -90 (degrees)

Figure 20. "Multiple files" tab

The *filename convention* settings "Prefix" and "Numbering" determine how the JPS files created will be named.

As the name of the setting implies, **Prefix** determines the prefix part of the filename. By default, PC-CDU will use the site name specified in the **Site Configuration** dialog window as the filename prefix.

The **Numbering** edit box allows you to select the desired *file numbering scheme*:

- If the option **Date & Time** is selected, the *numeric part* of the filename will look as follows: **YDDDHHMM**,

where

Y – last digit of the year [0-9],

DDD – day of the year [1-366],

HH – hours in the receiver time scale [00-23],

MM – minutes in the receiver time scale [00-59].

The date and time used for the filename will correspond to the first epoch recorded into the file.

- If the option **Ascending Count** is selected, the numeric part of the filename will vary between 0000 and 2147483647.

If the option **Ascending Count** has been chosen, the parameter **Start Count** will be enabled. In this edit box you can enter the *starting state* of the JPS file count, i.e. the numeric part of the name of the JPS file created first. This count will be incremented as new JPS files are opened.

New file every is associated with a pair of components, an edit box and a drop-down list box. Use the list box to select the desired time unit (day, hour or minute). Use the edit box to specify the interval (in the selected time unit) in which the current JPS file will be closed and the next one will be opened. Note that this interval must be an integer[10]. Also note that some of the multiple files created may be shorter (in terms of their duration in time) than it is specified in the corresponding edit box.

To better understand how multiple files are opened and closed in multiple file mode, let's consider the "artificial" time scale with the origin at $0^h00^m00^s$ [11]) as shown in the figure below. This time scale is divided into intervals equal to the period as specified by **New file every** fields.

The first of the multiple JPS files will be opened immediately after the **Start** button is pressed.

The first file will be closed and the second one opened as the 2nd interval starts, i.e. at ***t=2n*** (see the figure below), etc.

Time duration of the second and all the following multiple files (maybe except the last one) will be exactly equal to the selected file period.

To stop the multiple file data logging, press the **Stop** button. Note that the last file, too, can be shorter than it is specified in **New file every**.

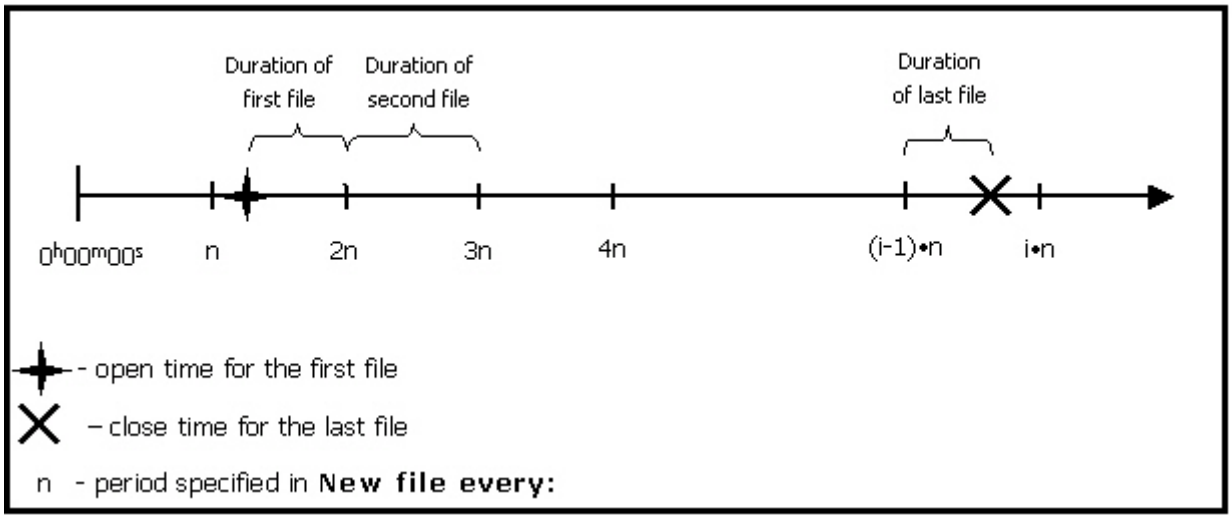


Figure 21. Generation of multiple files

If you want PC-CDU to overwrite the existing files whose names coincide with the names of the newly created files, select the **Overwrite existing files** checkbox before you start real-time logging.

Example. Assume that the **Ascending Count** and **Overwrite existing files** options have been selected. If you then press the **Start** button, PC-CDU will display a prompt as shown below.

[10]) Whatever time unit is selected

[11]) That is, at the beginning of the day when multiple file logging is started by pressing the **Start** button.

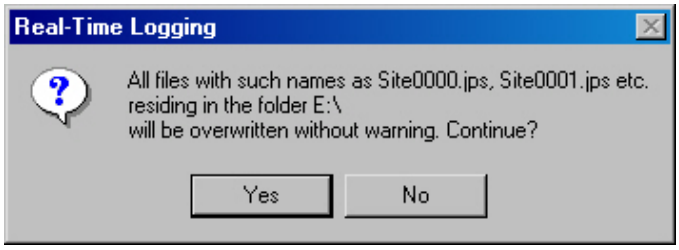

Real-Time Logging
All files with such names as Site0000.jps, Site0001.jps etc.
residing in the folder E:\
will be overwritten without warning. Continue?
Yes
No

Figure 22. "Overwrite existing files?" warning

In this example the destination folder is "E:\c-s-db\ses", the filename prefix is "Site".

Press **Yes** (Figure 22) to accept the prompt's default answer.

If you press **No**, you will return to the real-time logging window. There you will need to first uncheck the **Overwrite existing files** checkbox and then press the **Start** button to start data logging. In this case the *numeric parts* of the names of the JPS files recorded will be incremented starting from the first unused value, not necessarily from 0000.

If the **Autoconvert to RINEX** checkbox is selected, PC-CDU will automatically convert all newly created JPS files to RINEX. Note that this conversion is performed " on the move".

If you want to use the **Autoconvert to RINEX** function, make sure that the executable file **jps2rinex.exe** is available on your computer.

The **Setup converter** button, which is located immediately below the **Autoconvert to RINEX** checkbox, allows you to set up the JPS-to-RINEX converter, **jps2rinex.exe**. Pressing this button will open the dialog window **Converter to RINEX Setup** (Figure 23).

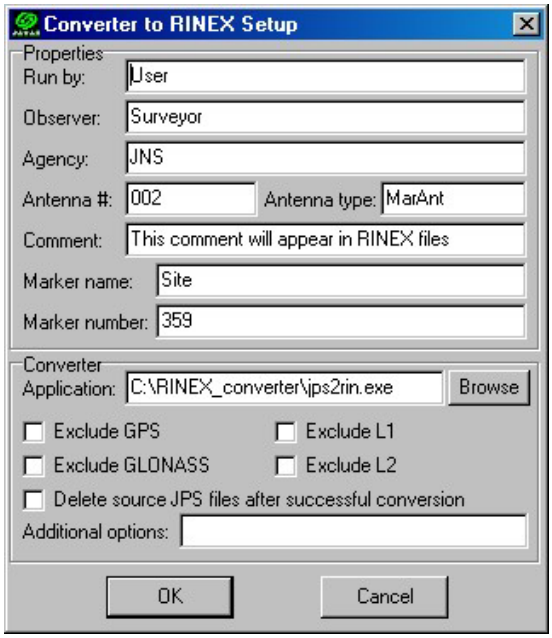


Figure 23. "Converter to RINEX Setup" window

The information specified in the **Properties** panel will be put in the header of the corresponding RINEX observation file:

- **Run by** – name of the person or agency launching the JPS-to-RINEX converter.
- **Observer** – name of the person who collected the data.

- **Agency** – name of the agency responsible for collecting the data.
- **Antenna #** - antenna number to be copied in the RINEX observation file.
- **Antenna type** – antenna type to be copied in the RINEX observation file.
- **Comment** – comment line(s).
- **Marker name** – name of the antenna marker.
- **Marker number** – number of the antenna marker.

In the **Application** edit box you must enter the full path to **jps2rin.exe**. Use the button **Browse** to select the desired filename path instead of typing it.

Use the checkbox **Exclude GPS** (**Exclude GLONASS**) to exclude from the resulting RINEX files all raw data measurements/ephemeris data corresponding to GPS (GLONASS).

Use the checkbox **Exclude L1** (**Exclude L2**) to exclude from the resulting RINEX files all L1 (L2) raw data measurements.

The checkbox **Delete source JPS files after successful conversion** means exactly what its name implies.

In the **Additional options** edit box you can enter any of the switches available for the windows console application **jps2rin.exe**. For more information about the switches, refer to the **Free Software** section at http://www.javadgps.com/jns/support/jps2rin.html.

In real-time data logging mode it is recommended that the checkbox **RTS/CTS handshaking** be selected and the baud rate be set to 115200 or higher.

Unlike downloading the recorded log-files from the receiver memory onto the computer, *real-time data logging* does not use any error detection/correction protocol in the course of the data transfer. As a result, some of the messages in the created JPS files may be corrupt (due to the serial port overrun or similar problems)[12].

4.2.3. 'Manual Mode' window

To go to the **Manual Mode** window, select the **Manual Mode** item from the **File** menu or press the keys **CTRL+M**.

This window (Figure 24) allows direct control of the receiver by using GRIL commands. In manual mode PC-CDU serves as a terminal communicating with the receiver, i.e. it allows you to send various receiver commands and get responses to these commands. For a complete list of commands supported by JNS receivers, refer to the GRIL Reference manual. (This document is available for download from the JNS website).

[12]) More precisely, some of the transferred bytes may be lost on the computer end.

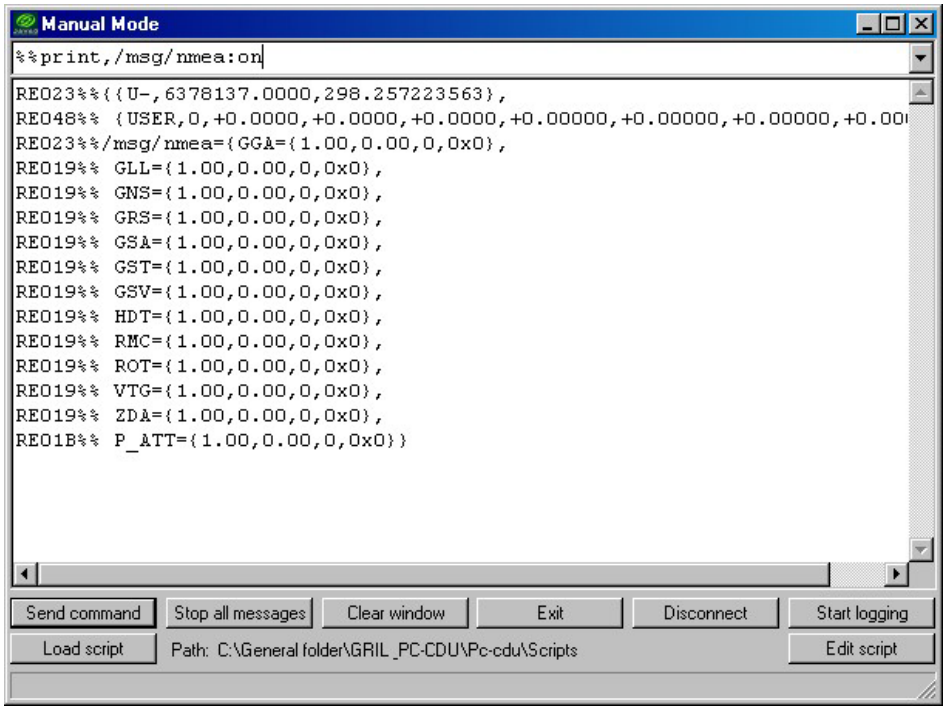


Figure 24. "Manual Mode" window

We recommend that you do not send any commands to the receiver from the **Manual Mode** window before you familiarize yourself with the GRIL Reference manual and acquire good knowledge of the receiver parameters.

At the top of the **Manual mode** window there is the command line box in which you can type a (new) command line. Alternatively, you can press to open the combo-box's list and select one of the previously used command lines. Note that there may be stored up to twenty (20) command lines in the list. Once the desired command line is typed (or selected), press the **Send command** button in the bottom-left corner of the **Manual Mode** window or just click the **Enter** key. The receiver's responses will be displayed in the *receiver replies* window located under the command line box.

Use the **Stop all messages** button to stop outputting any messages to the current terminal[13].

With the **Clear window** button you can clear the *receiver replies* window.

Press **Exit** to close the **Manual Mode** window.

The **Disconnect** button allows you to disconnect your computer from the receiver. Note however the difference between the **Disconnect** button you press in the **Manual Mode** window and the same named item you select from the **File** menu. If you press **Disconnect** in the **Manual Mode** window, PC-CDU will neither automatically disable RTS/CTS handshaking nor restore the receiver port's original baud rate (regardless of whether the **Restore the receiver's original baud rate on Disconnect** option has been selected).

[13]) After the button is pressed, PC-CDU will send an appropriate **dm** command to the receiver.

In other words, if you want to restore the receiver port's original baud rate, it can be achieved either by selecting the **Connect** item from the **File** menu or through the **Manual Mode** window. In the second case, make sure that the command you use to change the receiver port's baud rate is executed immediately before clicking the **Disconnect** button.

The **Start logging** button allows you to copy to a text file all information that has been displayed in the receiver replies window during the session.

With the **Load Script** button you can load into the receiver the desired script file.

Use **Edit Script** if you need to edit your script file.

For more information about scripts, see Appendix A. PC-CDU Scripts.

4.2.4. 'Receiver Configuration' window

To go to the **Receiver Configuration** window, select **Receiver** from the **Configuration** menu, or alternatively press the keys **CTRL+V**.

If you select the **Receiver** option from the **Configuration** menu while holding down the **Shift** key, the **Main** window will remain open.

You will see a dialog window comprising eight tabs. Each tab has an **Apply** button. Pressing this button instructs PC-CDU to accept the settings you made in the tab without closing the window. Note however that each **Apply** button serves only "its own" tab and cannot affect the other tabs' settings.

Press **Refresh** to update the currently displayed window with the new or original settings.

The **OK** button, unlike the individual **Apply** buttons, allows you to accept the selected settings for all eight tabs at a time. In addition pressing **OK** will close the **Receiver Configuration** window.

Use the **Exit** button to close the **Receiver Configuration** window without accepting the settings you have made since **Apply** was pressed last.

Pressing **Save** will open the **Save setup to a script** window. In this window you can save the current receiver settings to a script file. Script files normally have the extension **.jpc**. Later you can load the desired script file to the receiver, thus enabling several necessary receiver settings with a single operation.

The button **Set all parameters to defaults** does exactly what its name implies.

4.2.4.1. General

Figure 25. shows the **Receiver Configuration** window's **General** tab.

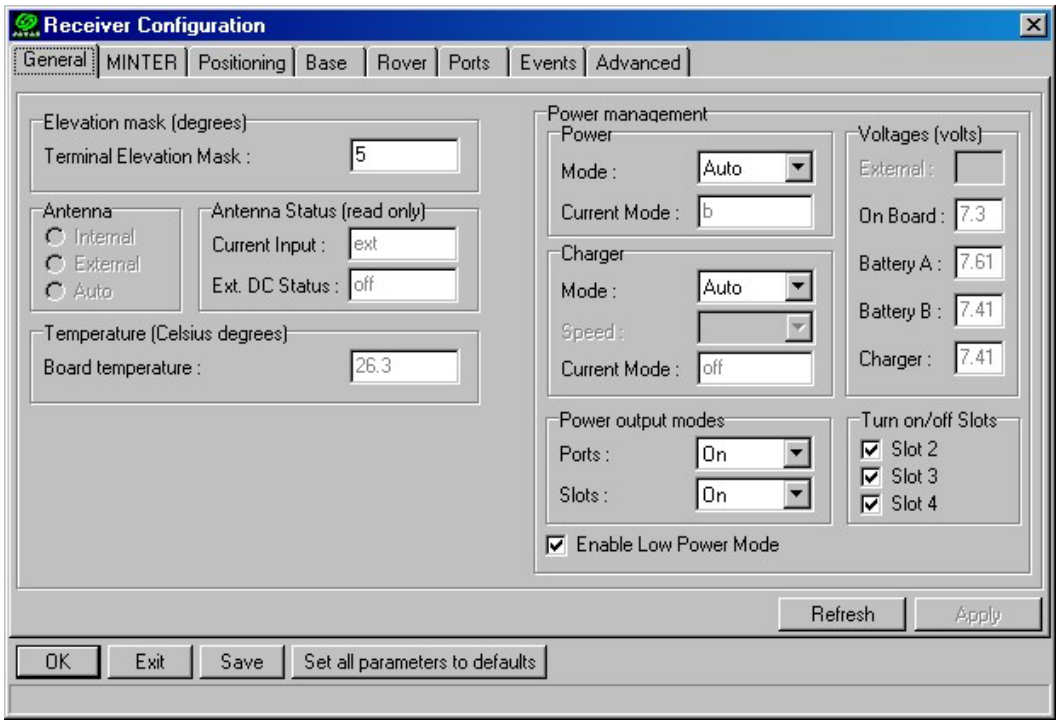


Figure 25. "General" tab

In the **Terminal Elevation Mask** edit box you enter the minimum elevation (i.e., the elevation mask angle) for the satellites whose data will be output to the current terminal. This setting relates to the receiver parameter **/par/out/elm/cur/term**.

The radio buttons **Internal**, **External** and **Auto** from the **Antenna** group are used to select the desired antenna type. These buttons are associated with the receiver parameter **/par/ant/inp**. Table 5 shows what antenna type settings are allowed for different receiver models and board types.

Table 5. Allowed *antenna type* settings

Receiver model	Receiver board	Default	Allowed values
Any	JPS_3, Eurocard	External	Internal, External
Any	JPS_4, JPS_4_2	External	Internal, External, Auto
OEM	JGG20	Not available	Not available
OEM, LEGACY-H	HE_GG, HE_GD	Not available	Not available
HIPER	HE_GG, HE_GD	Auto	Internal, External, Auto
OEM, Legacy-E, ODYSSEY-E	E_GGD, HE_GG, HE_GD	Not available	Not available

Note that such receiver models as Prego, Regency with JPS_4 board and Odyssey with JPS_4 board are capable of automatically detecting an external antenna only at receiver start-up time. Therefore if you want to switch from the internal antenna to an external one while in **auto**, you will have to turn the receiver off and then back on.

The Regency and Odyssey receivers using JPS_4_2 are capable of automatically detecting an external antenna without switching the receiver off and back on.

Antenna Status

- The indicator **Current Input** shows what antenna type is actually being used by the receiver:

  int – the internal antenna is being used.

  ext – an external antenna is being used.

  This flag relates to the receiver parameter **/par/ant/curinp**.

- The indicator **Ext. DC Status** shows if the external antenna draws any dc:

  off – the external antenna draws no dc

  normal – the external antenna draws normal dc

  overload – the external antenna draws higher dc then expected

  This indicator is associated with the receiver parameter **/par/ant/dc**.

The indicator **Board temperature** shows the receiver board's current temperature. This indicator is associated with the receiver parameter **/par/dev/thermo/out**.

Power management

Power

- Use the drop-down list box Power/**Mode** to select the desired power source for the receiver:

  Auto – receiver will automatically select the power source

  Mix – receiver will automatically detect and start consuming power from the source with the highest voltage

  Battery A – receiver will consume power from battery A

  Battery B – receiver will consume power from battery B

  External – an external power supply will be used.

  This setting is associated with the receiver parameter **/par/pwr/mode**.

- The indicator **Current Mode** shows what power source is being used at the moment. This setting is associated with the receiver parameter **/par/pwr/curmode**.

Charger

- Use the drop-down list box Charger/**Mode** to select the battery charging mode:

  Off – receiver will not charge the batteries

  Charge A – receiver will charge only battery A

  Charge B – receiver will charge only battery B

  Auto – receiver will automatically detect and charge the detected batteries.

  This setting is associated with the receiver parameter **/par/pwr/charge/bat**.

- Use the **Speed** list box to set the desired speed of battery charge cycle. You can select between Normal and Fast dc levels. The corresponding receiver parameter is **/par/pwr/charge/speed**.
- The flag **Current Mode** shows which of the batteries, **a**, **b** or none (**off**) is being charged at the moment. The corresponding receiver parameter is **/par/pwr/charge/curbat**.

Voltages

- The indicator **External** shows the external power supply's voltage. The corresponding receiver parameter is **/par/pwr/ext**.
- The indicator **On Board** shows what is the actual voltage drawn by the receiver board. The corresponding receiver parameter is **/par/pwr/board**.
- The indicators **Battery A** and **Battery B** show the voltage on batteries A and B, respectively. The corresponding receiver parameters are **/par/pwr/bat/a** and **/par/pwr/bat/b**.
- The indicator **Charger** shows the charger's output voltage during battery charging. The corresponding receiver parameter is **/par/pwr/charger**.

Power output modes

- The checkbox **Ports A,B** allows you to turn power on and off for ports A and B. The corresponding receiver parameter is **/par/pwr/out/ab**.
- With the checkbox **Port C** you can turn power on and off on port C. The corresponding receiver parameter is **/par/pwr/out/c**.

The two above-described parameters are applicable to the Odyssey receiver only.

- The list box **Ports** governs power output on serial ports:
  - **On** – the power board will feed all available serial ports via the corresponding pins when the receiver is turned on. If the receiver is turned off, there will not be any power on the ports.

- **Off** – power, on all available serial ports, will be absent even if the receiver is turned on.
- **Always** – the power board will feed all available serial ports even if the receiver is turned off.

The **Ports** list box is associated with the receiver parameter **/par/pwr/ports**.

- With the **Slots** list box the user governs power output on the internal slots:
  - **On** – means that all slots are powered if the receiver is turned on.
  - **Off** – means that internal slots will not be powered even if the receiver is turned on.
  - **Always** – means that internal slots will be powered even if the receiver is turned off.

The list box is associated with the receiver parameter **/par/pwr/slots**.

Turn on/off Slots

- Select the **Slot 2**, **Slot 3** and **Slot 4** checkboxes to enable the corresponding internal slots. These checkboxes correspond to the receiver parameters **/par/pwr/switch** and **/par/pwr/switch/N**. The first parameter allows you to enable all slots simultaneously. The second parameter allows you to enable only one slot at a time. Here N is the slot number (2, 3, 4).

The list boxes **Ports**, **Slots** and the **Turn on/off Slots** group box, are applicable to the HiPer and Odyssey-E receivers only.

If the checkbox **Enable Low Power Mode** is selected, the receiver's processor will go into *low power consumption* mode. The corresponding receiver parameter is **/par/lpm**.

4.2.4.2. MINTER

In this tab (see Figure 26) you can set up receiver parameters related to MINTER (MINimum INTERface).

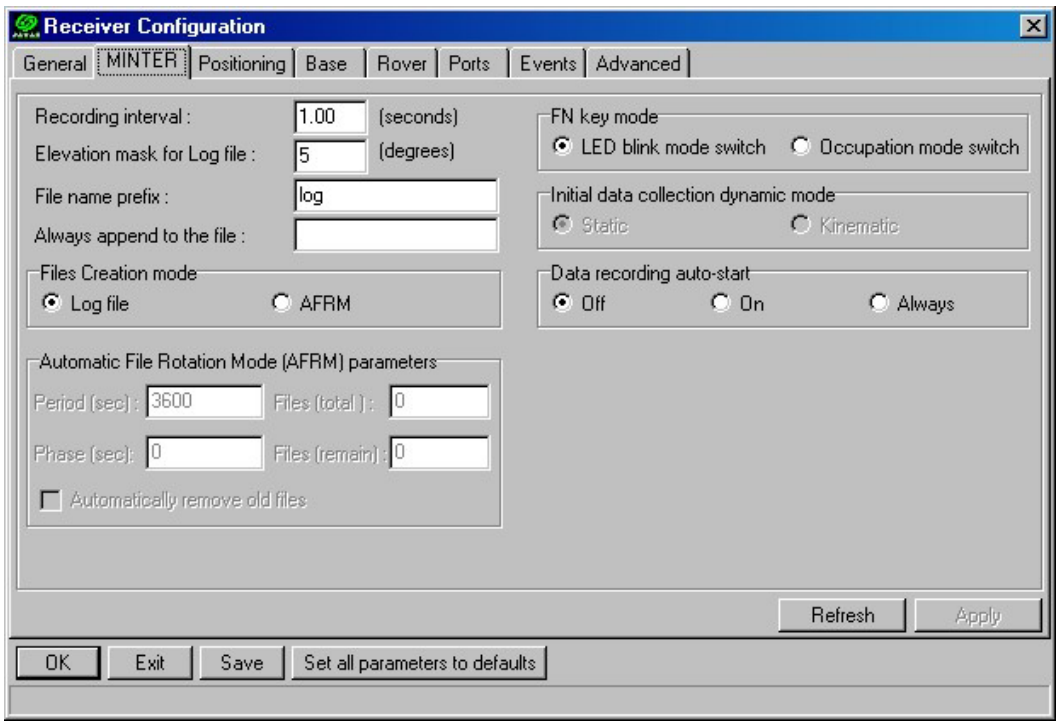


Figure 26. "MINTER" tab

The recording time interval specified in the **Recording interval** edit box will be used when receiver files are opened and logged via MINTER, i.e. by pressing the FN button. This setting is used not only when logging a single log-file but also when logging receiver data in AFRM mode. The corresponding receiver parameter is **/par/log/sc/period**. Note that this parameter cannot exceed 86400 seconds.

If you set an incorrect recording interval (the **Recording interval** edit box), PC-CDU will run a utility called **Output Period Setup Wizard**. For more information on the Wizard, see Appendix B. Output Period Setup Wizard.

Elevation mask for Log file specifies the minimum elevation angle for the satellites whose data will be put in the receiver files logged via Minter, i.e. by pressing FN. The corresponding receiver parameter is **/par/out/elm/cur/log**.

File name prefix specifies what prefix will be added to the names of the receiver files created via Minter, i.e. by pressing FN. The prefix can be up to 20 characters long. Default is **log**. The corresponding receiver parameter is **/par/cmd/create/prefix**.

If you want the new receiver data to be appended to an existing log-file, enter the desired filename in the **Always append to the file** edit box. The setting can be up to twenty characters long. The corresponding receiver parameter is **/par/button/file**.

Files Creation mode

- Two operation modes are possible for FN button. If the **Log file** radio button has been selected, pressing FN will result in closing the current log-file or, if data logging has been off, opening a new log-file. If **AFRM** has been selected, pressing FN will enable this mode, if it has been disabled, and vice versa. The associated receiver parameter is **/par/button/rot**.

Automatic File Rotation Mode (AFRM) parameters

- **Period** specifies the time duration of each of the multiple log-files created in AFRM mode. The corresponding receiver parameter is **/par/log/rot/sc/period**.
- **Phase** specifies the "phase" (i.e. constant time shift) of the multiple log-files created in AFRM mode. The corresponding receiver parameter is **/par/log/rot/sc/phase**.
- Use the edit box **Files (total)** to specify how many multiple log-files must be created in AFRM until this mode automatically turns off. The corresponding receiver parameter is **/par/log/rot/sc/cout**. Zero means that an unlimited number of log-files will be created.
- From **Files (remain)** you can see how many log-files are left for the receiver to create in AFRM. The associated receiver parameter is **/par/log/rot/count**.
- If the checkbox **Automatically remove old files** is selected, the receiver will start, should there be no free space left in the receiver memory, overwriting the least recent files[14]. The corresponding receiver parameter is **/par/log/rot/rmold**.

FN key mode

- You use these two radio buttons to program how the receiver will react to clicking FN (i.e. keeping the button depressed for less than one (1) second). In **LED blink mode switch** mode, clicking FN will toggle between Minter's standard and extended information modes. (For more details, see the MINTER User's manual). In **Occupation mode switch** mode you click FN to get the receiver to insert into the corresponding log-file a message indicating that the occupation type has been changed from static to kinematic, or vice versa. The corresponding receiver parameter is **/par/button/action**.

Initial data collection dynamic mode

- These radio buttons specify the starting *occupation type* descriptor[15] that will be inserted at the beginning of each receiver files logged via MINTER. You select **Static** and **Kinematic** to specify that the corresponding log-file will start with a static and kinematic occupation, respectively. The associated receiver parameter is **/par/button/dyn**.

Data recording auto-start

You can program how your receiver will behave in the event of a power failure. The corresponding receiver parameter is **/par/button/auto**.

---

[14]) In other words, existing files will be overwritten based on the FIFO principle.

[15]) This event message is called _DYM.

Depending on which of the three radio buttons has been selected, your receiver will behave as follows:

Table 6. How Data recording auto-start works

Scenario	"Off"	"On"	"Always"
Before a power failure occurred, receiver data were being logged to the file with the name specified in "Always append to the file"	Data logging will not resume automatically after the power is restored.	Receiver will resume data logging (to the same file) after the power is restored.	Receiver will resume data logging (to the same file) after the power is restored.
Before a power failure occurred, receiver data were being recorded in a default-named file (i.e. the string "Always append to the file" was empty)	Data logging will not resume automatically after the power is restored.	A new log-file will be opened after the power is restored and the receiver will start recording data in this file	A new log-file will be opened after the power is restored and the receiver will start recording data in this file
Before a power failure occurred, the string Always append to the file had a non-empty value but data logging hadn't been started yet	A file with this name will not be opened and data logging will not be started after the power is restored.	A file with this name will not be opened and data logging will not be started after the power is restored.	After the power is restored a file with this name will be opened and data logging will be started
Before a power failure occurred, the string Always append to the file was empty and data logging was off	Data logging will not be started after the power is restored.	Data logging will not be started after the power is restored.	After the power is restored, a new (default-named) log-file will be opened and data logging will be started.

Also, if the option **Always** is selected, your receiver will automatically start logging data (to a newly created or an existing file) in the following three cases:

1. After switching the receiver ON with the Minter (I) button.
2. After executing the **Reset receiver** command (the corresponding receiver parameter is **/par/reset**)
3. After waking the receiver from sleep mode[16].

[16]) Recall that you use the parameter **/par/sleep** to make your receiver go into sleep mode.

4.2.4.3. Positioning

Figure 27. shows the **Positioning** tab.

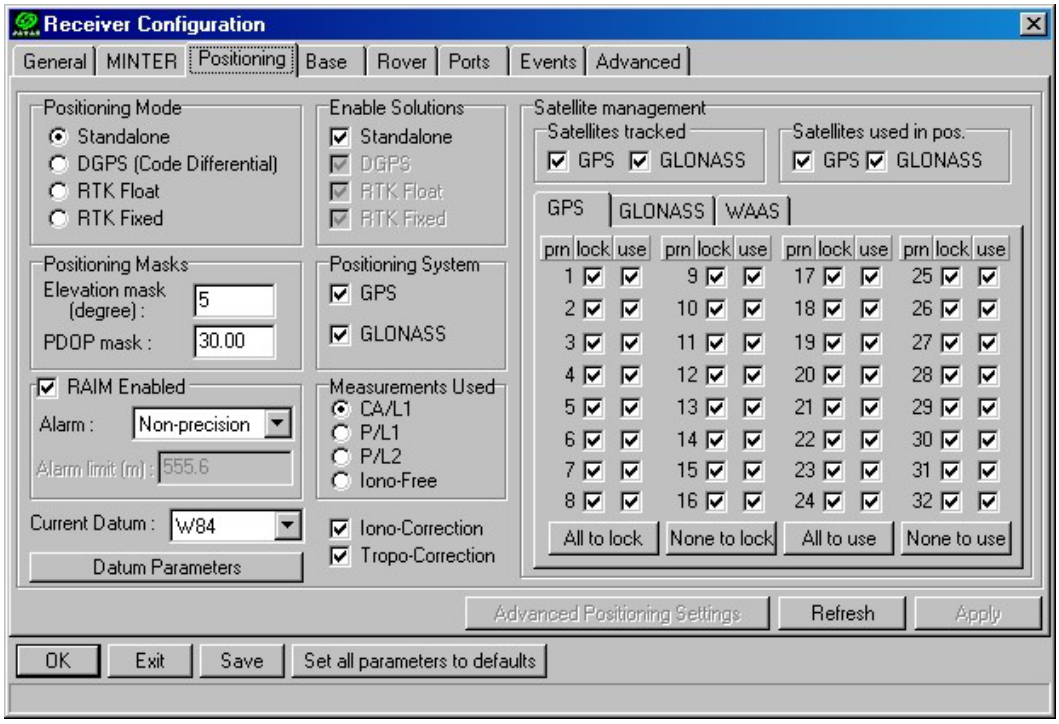


Figure 27. "Positioning" tab

Positioning Mode

- These four radio buttons are included in the **Positioning** tab only for user convenience. They simply "mirror" the same named buttons from the **Rover** tab. For more information about this radio button group, see 4.2.4.5. The receiver parameter associated with these radio buttons is **/par/pos/mode/cur**.

Enable Solutions

- These four checkboxes are included in the **Positioning** tab only for user convenience. They simply "mirror" the same named checkboxes from the **Rover** tab. If the **Standalone** checkbox has been checked and the rover receiver is being run in differential mode, the receiver will report its current standalone position instead of the DGPS (or RTK) position if the latter is unavailable in the current epoch. The corresponding receiver parameter is **/par/pos/mode/sp**.
- Note that the checkboxes **Code Differential**, **Phase Float** and **Phase Fixed** are always grayed out in this version of PC-CDU.

Positioning Masks

- In the **Elevation mask** edit box you specify the elevation mask angle for the satellites used in position computation. The corresponding receiver parameter is **/par/pos/elm**.
- In the **PDOP mask** edit box you specify the threshold value of PDOP that disables position computation. If PDOP exceeds this mask during a period of time, the receiver's position will not be computed over the corresponding epochs. The associated receiver parameter is **/par/pos/pdop**.

RAIM Enabled

- If the **RAIM Enabled** checkbox is checked, the receiver will automatically detect and reject measurement outliers. The corresponding receiver parameter is **/par/pos/raim/mode.**
- The drop-down list box **Alarm** is associated with the receiver parameter **/par/pos/raim/al/mode.**
- The **Alarm limit** edit box relates to the receiver parameter **/par/pos/raim/al/manual.**

From the drop-down list box **Current Datum** you select the datum used in position computation. This setting is associated with the receiver parameter **/par/pos/datum/cur.**

Pressing the **Datum Parameters** button will open the **<Datum ID> Datum Parameters** window (Figure 28). In this window you can not only view the ellipsoid and transformation parameters of the datums selectable from the **Current Datum** list box but also edit the transformation parameters for **USER** and **P90.** In addition you can edit the ellipsoid parameters of **USER** in this window.

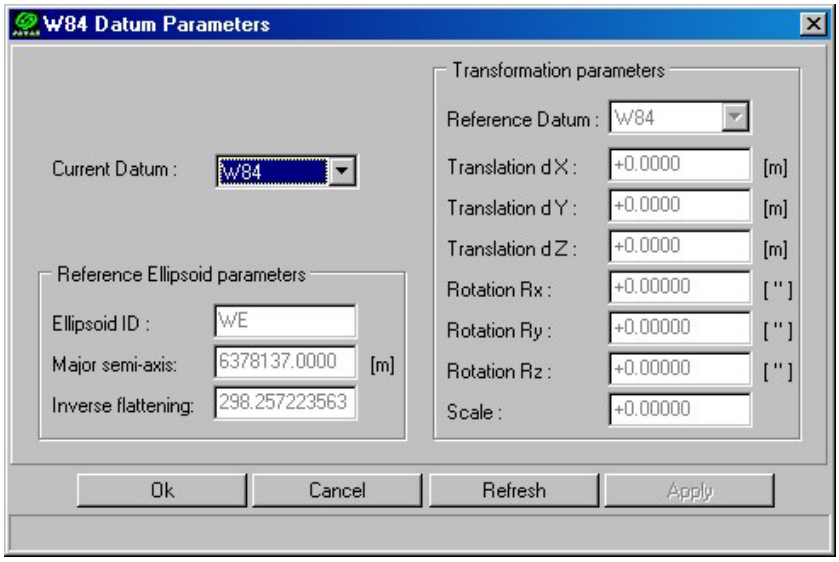


Figure 28. "<DATUM ID> Datum Parameters" window

Positioning System

- Select the checkboxes **GPS** and **GLONASS** if you want the corresponding satellite constellations to be used in position computation. These checkmarks are associated with the receiver parameter **/par/pos/sys**.
  Note, however, that the selected satellite constellation will indeed be used in position computation only if the corresponding **Satellites to use** checkbox from the **Satellites management** panel is selected as well.

Measurements Used

- This radio button group shows what code measurements will be used to compute the receiver's standalone position. The corresponding receiver parameter is **/par/pos/sp/meas.**

For a single-frequency receiver, the radio buttons **P/L1**, **P/L2** and **Iono-Free** will be grayed out.

If the checkbox **Iono-Correction** is selected, the receiver will correct the pseudoranges for ionosphere (based on the model defined in ICD-GPS-200, Revision C) before using them in position computation. The corresponding receiver parameter is **/par/pos/sp/iono**. Note that if both **Iono-Free** and **Iono-Correction** are selected, the first overrides the second.

If the checkbox **Tropo-Correction** is selected, the pseudoranges will be corrected for troposphere before being used in position computation. The corresponding receiver parameter is **/par/pos/sp/tropo**.

Note that the above mentioned receiver parameters, **/par/pos/sp/meas**, **/par/pos/sp/iono** and **/par/pos/sp/tropo**, apply only to absolute position computation.

Satellites management

Satellites tracked

- The checkboxes **GPS** and **GLONASS** are used to allow tracking of GPS and GLONASS satellites, respectively. The **GPS** checkbox is associated with the receiver parameter **/par/lock/gps/sat**. The **GLONASS** checkbox relates to **/par/lock/glo/fcn**.

Satellites Used in pos.

- Use the checkboxes **GPS** and **GLONASS** to specify what satellite systems (only GPS, only GLONASS, or both) will be used in position computation. The **GPS** checkbox is associated with the receiver parameter **/par/pos/gps/sat**. The **GLONASS** checkbox corresponds to **/par/pos/glo/sat**.

GPS | GLONASS | WAAS

Use these tabs to explicitly specify which of the GPS, GLONASS and WAAS satellites are enabled for tracking and position computation.

The first tab, as its name implies, deals with the GPS satellites (Figure 29).

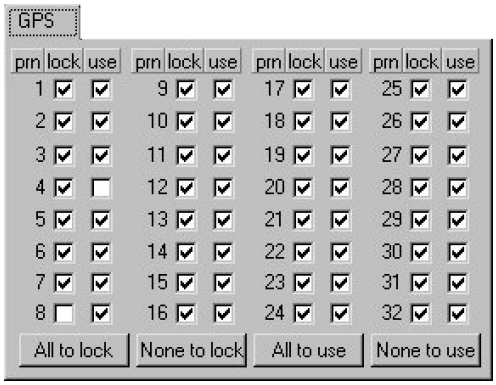

GPS
prn lock use prn lock use prn lock use prn lock use
1 9 17 25
2 10 18 26
3 11 19 27
4 12 20 28
5 13 21 29
6 14 22 30
7 15 23 31
8 16 24 32
All to lock
None to lock
All to use
None to use

Figure 29. "GPS" tab

The tab displays three columns, **prn**, **lock** and **use**, which are described in Table 7.

Table 7. Description of data displayed in the GPS tab.

Notation	Meaning
prn	GPS satellites' pseudo random numbers
lock	Checkmarks in this column indicate that the corresponding satellites are enabled for tracking. In Figure 29 GPS satellite PRN 8 is disabled for tracking.
use	Checkmarks in this column indicate that the corresponding satellites are enabled for position computation. In Figure 29 GPS satellite PRN 4 is disabled for position computation

A GPS satellite's *system number* is identical to its PRN number.

Use the buttons **All to lock** and **All to use** to select all GPS satellites at one time.

Use the buttons **None to Lock** and **None to use** to deselect all GPS satellites at one time.

The second tab, as its name implies, deals with the GLONASS satellites (Figure 30).

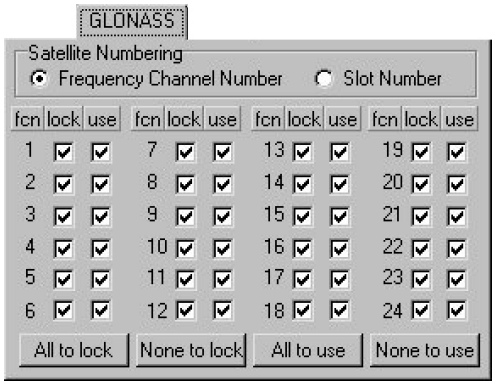


Figure 30. "GLONASS" tab

Satellite Numbering

- For user convenience, GLONASS satellites can be displayed ordered either by their **Frequency Channel Number** or by the **Slot Number**.

The tab displays three columns, **fcn/sat**, **lock** and **use**, which are described in Table 8.

Table 8. Description of data displayed in the GLONASS tab

Notation	Meaning
fcn/sat	GLONASS satellites' frequency channel numbers, if the Frequency Channel Number checkbox is selected. GLONASS satellites' slot numbers, if the Slot Number checkbox is checked.
lock	Enable GLONASS satellites for tracking.
use	Use this GLONASS satellite for position computation.

Use the buttons **All to lock** and **All to use** to select all GLONASS satellites at one time.

Use the buttons **None to lock** and **None to use** to deselect all GLONASS satellites at one time.

The third tab, as its name implies, deals with the WAAS/EGNOS satellites (Figure 31).

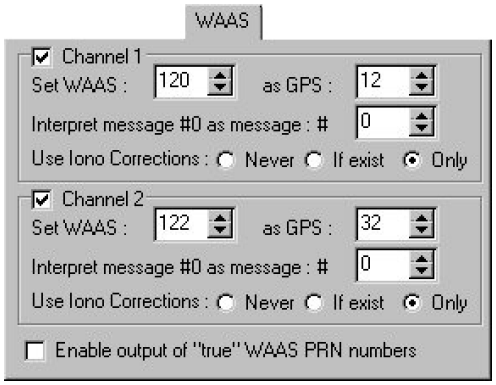

WAAS
Channel 1
Set WAAS : 120
as GPS : 12
Interpret message #0 as message : # 0
Use Iono Corrections : Never If exist Only
Channel 2
Set WAAS : 122
as GPS : 32
Interpret message #0 as message : # 0
Use Iono Corrections : Never If exist Only
Enable output of "true" WAAS PRN numbers

Figure 31. "WAAS" tab

A WAAS-enabled JNS receiver allows simultaneous tracking of two WAAS satellites. Either of the WAAS satellites is allocated its own channel. Below we will show how to set up Channel 1 (Channel 2 is handled in the same manner).

The checkbox **Channel 1**, if selected, allows you to specify necessary settings for the desired WAAS satellite.

- You use the spin-boxes **Set WAAS** and **as GPS** to associate the selected WAAS PRN (120-138[17]) with an appropriate GPS PRN (1-32). It is recommended to select for this purpose one of the GPS PRNs that are not used in the current GPS constellation. At writing this manual, the unused GPS PRNs are: 12, 16, 19 and 32. The spin-boxes correspond to the receiver parameter **/par/waas/1/sat**.
- The spin-box **Interpret message #0 as message: #** disables message 0. The corresponding receiver parameter is **/par/waas/1/instead0**.
- The radio button group **Use Iono Corrections** allows you to set the desired ionosphere correction mode. The radio buttons are associated with the receiver parameter **/par/waas/1/ion**.
  - **Never** – ignore any iono corrections received from the WAAS satellite(s).
  - **If exist** – use in position computation not only the satellites for which the WAAS Iono Corrections are available but also all the other acquired satellites.
  - **Only** – use in position computation only the satellites for which the WASS Iono Corrections are available. Note that this is the default option for the radio button group.

To make **WAAS Channel 2** settings, you use the same receiver parameters but replacing "1" with "2", e.g., **/par/waas/2/sat** for **/par/waas/1/sat**.

If the checkbox **Enable output of "true" WAAS PRN numbers** is selected, the WAAS satellites will have their true WAAS PRNs (not "GPS associated") in the corresponding 'Satellite Indices' messages. The receiver parameter relating to this checkbox is **/par/waas/numb**.

[17]) WAAS satellites with PRNs 122 and 134. EGNOS satellites with PRNs 120 and 131.

4.2.4.4. Base

With the **Base** tab, you can configure the receiver for use as a reference station (Figure 32).

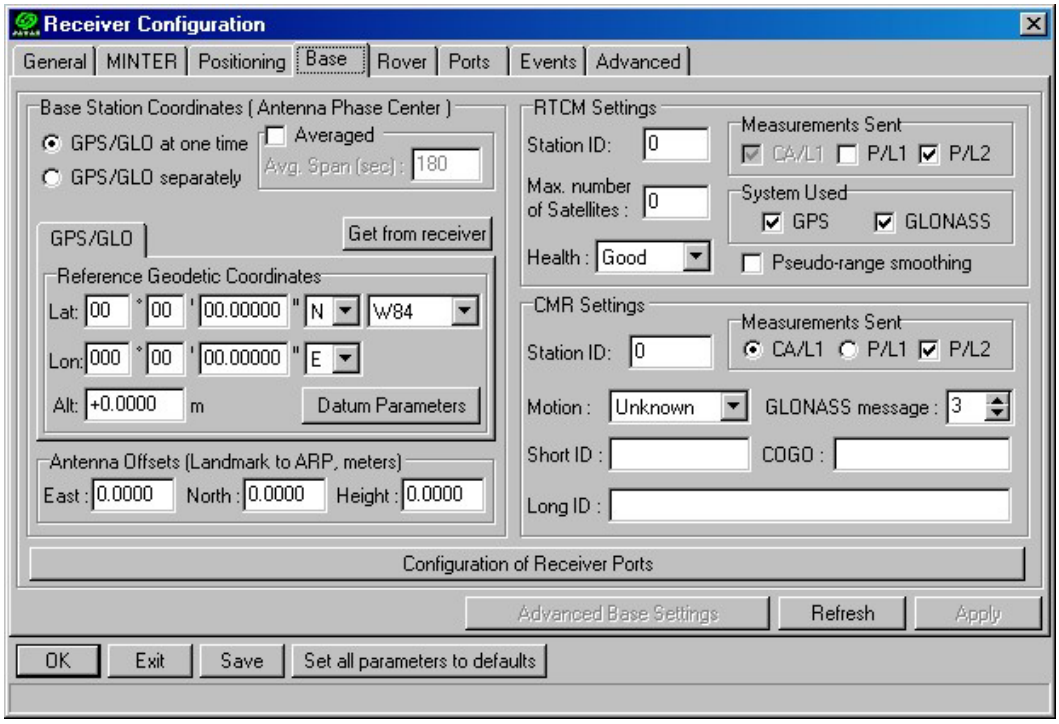


Figure 32. "Base" tab

Base Station Coordinates (Antenna Phase Center)

Note that the reference geodesic coordinates you specify in this tab will relate to the antenna ***L1*** phase center.

There are three ways to enter the geodesic coordinates of the base antenna's L1 phase center:

(1) Type in the precise latitude/longitude and ell. height manually (use the **Lat**, **Lon** and **Alt** edit boxes).

(2) Use the instant absolute coordinates from the receiver (by pressing the **Get from receiver** button)

(3) Use the absolute coordinates averaged over the specified time interval (with the **Averaged** and **Avg.Span** controls. The corresponding receiver parameters are **/par/ref/avg/mode** and **/par/ref/avg/span,** respectively.

As the names of the radio buttons **GPS/GLO at one time** and **GPS/GLO separately** imply, these allow the user to specify for GPS and GLONASS either common reference coordinates or "individual" reference coordinates. In most cases it is recommended to use the same reference coordinates both for GPS and GLONASS. After the user has selected **GPS/GLO separately**, he/she will see the **GLONASS** tab appear on the screen too. The **GPS/GLO at one time** radio button is associated with the receiver parameter **/par/ref/pos//geo**. **GPS/GLO separately** corresponds to the receiver parameters **/par/ref/pos/gps/geo** for GPS and **/par/ref/pos/glo/geo** for GLONASS.

Pressing the **Datum Parameters** button will open the **<Datum ID> Datum Parameters** window. In this window you can not only view the ellipsoid and transformation parameters of the datums selectable from the **Current Datum** list box but also edit the

transformation parameters for **USER** and **P90**. In addition you can edit the ellipsoid parameters of **USER** in this window.

Structurally this window is similar to that shown in Figure 28.

In the **East**, **North** and **Height** edit boxes, the user specifies the offsets from the marker to ARP. These edit boxes corresponds to the receiver parameter **/par/ref/ant/offs**.

RTCM Settings

The **Station ID** edit box is associated with the receiver parameter **/par/rtcm/base/stid**. This parameter allows the user to assign a separate station ID to each reference station working in the area.

With the **Max. number of Satellites** edit box, the user specifies the maximum number of satellites allowed for use in RTCM messages types 18 through 21. **0** means that all of the available satellites will be included in the above mentioned RTCM message types. If an RTK system has a slow modem (the baud rate is less than 9600 bps), it is recommended to restrict the number of satellites included in these messages. The limitation allows the user to reduce the amount of data sent by the base station, which helps to avoid the data link overload. If the actual number of satellites in sight exceeds the value entered in this edit box, the RTCM messages will include data only from the satellites with higher elevations and the number of satellites included in the RTCM messages will not be greater than that specified in the edit box. This edit box is associated with the receiver parameter **/par/rtcm/base/svm**.

The **Health** list box is intended to define the reference station status:

- **Good** – station is operating normally.
- **Bad** – station is not working normally.
- **Unknown** – station health status is unknown.

The corresponding GRIL parameter is **/par/rtcm/base/health**.

With the radio buttons **Measurements Sent**, the user specifies the measurement types that will be included into the RTCM message types 18 through 21. Currently, the mentioned RTCM messages always contain C/A measurements. You can also include either or both P/L1 data[18] and P/L2 data[18] in these messages. The checkbox **CA/L1** corresponds to the receiver parameter **/par/rtcm/base/meas/ca**. The checkbox **P/L1** is associated with the receiver parameter **/par/rtcm/base/meas/p1**. The **P/L2** checkbox is associated with the receiver parameter **/par/rtcm/base/meas/p2**.

The **GPS** and **GLONASS** checkboxes, which are grouped together within the **System Used** area, indicate the satellite constellations included in the RTCM message types 18, 19, 20 and 21. These checkboxes are associated with the receiver parameter **/par/rtcm/base/sys**.

If the **Pseudo-range smoothing** checkbox is selected, the receiver will use smoothed pseudoranges in the RTCM message types 19 through 21. This checkbox corresponds to the receiver parameter **/par/rtcm/base/smooth**.

[18]) On condition that the JNS receiver is configured as a dual-frequency unit.

CMR Settings

The **Station ID** edit box corresponds to the receiver parameter **/par/cmr/base/stid**. With this parameter the user can specify the base station ID, which will be included into the CMR messages transmitted by this base station. On the rover side, this ID allows easy identification of the reference station whose CMR messages are being received by the rover receiver.

The list box **Motion** characterizes the motion of the reference station:

- **Unknown** – the motion state is undetermined.
- **Static** – the receiver is motionless.
- **Kinematic** – the receiver is in motion.

This list box corresponds to the receiver parameter **/par/cmr/base/motion**.

Use the **Short ID**, **COGO** and **Long ID** to include the reference station's point feature code[19] into CMR message type 2. These edit boxes are associated with the receiver parameter **/par/cmr/base/desc**.

The radio buttons **CA/L1**, **P/L1** and the checkbox **P/L2**, which are grouped within the **Measurements Sent** area, allow the user to specify which measurement types will be included into the corresponding CMR messages broadcasted by the reference station. The radio buttons correspond to the receiver parameter **/par/cmr/base/pcode**. The checkbox **P/L2** is associated with the receiver parameter **/par/cmr/base/meas/p2**. If the receiver is a single-frequency unit, the controls **P/L1** and **P/L2** will not be available.

The spin box **GLONASS message** allows the user to specify which message types will be associated with GLONASS measurements. You can choose any unused message types between 3 and 7. The spin box is associated with the receiver parameter **/par/cmr/base/glo/type**.

Click the **Configuration of Receiver Ports** button to go to the **Ports** tab. For a description of this tab, refer to section 4.2.4.6 of this manual.

[19]) Feature code is an alphanumeric code used to describe a survey point.

4.2.4.5. Rover

In the tab, you can configure your receiver as a rover station (see Figure 33).

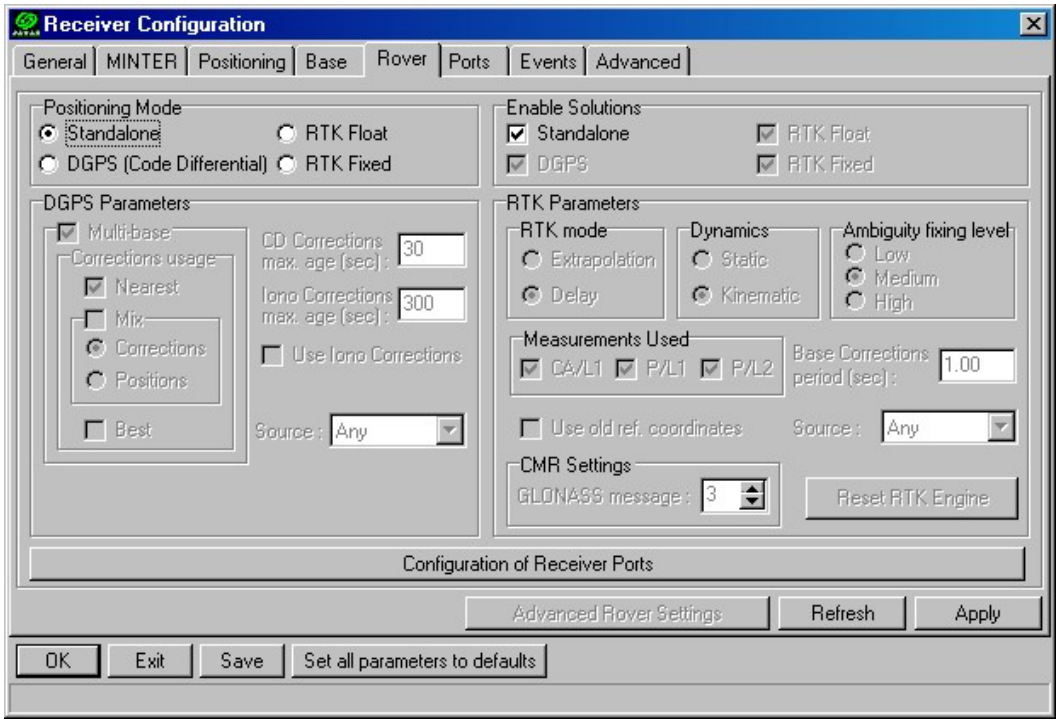


Figure 33. "Rover" tab

The **Positioning Mode** radio button group permits the user to select one of the four available positioning modes.

DGPS Parameters

To switch a roving receiver to Multi-base mode, select the **Multi-base** checkbox. In this mode, the rover is able to use differential corrections received from more than one reference station[20]. This checkbox is associated with the receiver parameter **/par/pos/cd/mult/mode.**

Correction usage

If the user selects the **Nearest** checkbox, the rover will use differential corrections transmitted by the nearest reference station. The checkbox corresponds to the receiver parameter **/par/pos/cd/mult/nearest.**

When working in the **Nearest** mode, make sure that the checkboxes **Mix** and **Best** are unchecked.

The **Mix** checkbox allows the user to run the rover station in 'average' mode.

The checkbox is associated with the receiver parameter **/par/pos/cd/mult/mix.**

When the rover runs in this mode, the **Best** checkbox must be unselected.

[20]) Currently, this mode allows the rover to use up to five reference stations simultaneously.

With the radio buttons **Corrections** and **Positions**, the user specifies which of the averaging modes will be used for position computation. If both the **Mix** checkbox and **Corrections** radio button are selected, the rover will be averaging differential corrections received from different reference stations. If the user selects the **Mix** checkbox and **Positions** radio button, the receiver will average the computed positions, not the received corrections. These radio buttons correspond to the receiver parameter **/par/pos/cd/mult/mixmode**.

If the **Best** checkbox is selected, the receiver will use differential corrections that correspond to the most precise of the obtained position estimates. *Best* means that the solution has the least RMS error. The **Best** checkbox is associated with the receiver parameter **/par/pos/cd/mult/best**.

In the **CD Corrections max. age** edit box, the user can set the maximum age (in seconds) of the code differential corrections used for position computation. Here you can enter an integer value between 1 and 1200. Default is 30. If the age of the corrections exceeds the value specified in this edit box, the rover will compute a stand-alone position. The edit box relates to the receiver parameter **/par/pos/cd/maxage**.

Use the **Iono Corrections max. age** edit box to specify the maximum age (in seconds) of the ionosphere corrections used for position computation. The corresponding receiver parameter is **/par/pos/cd/iono/maxage**.

If you set the **Use Iono Corrections** checkbox to 'on', the rover receiver will use in position computation both the ionosphere corrections from RTCM message type 15 and differential corrections from RTCM messages types 1 and 31 (or 9 and 34). This checkbox is associated with the receiver parameter **/par/pos/cd/ionofree**.

The list box **Source** serves to specify the source (port) from which the receiver will use differential corrections for position computation. This list box relates to the receiver parameter **/par/pos/cd/port**.

The receiver uses this parameter only if **Multi-base** mode is unchecked.

Enable Solutions

The **Standalone** checkbox, if selected, allow the receiver, running in a differential mode, to yield the absolute position in case the receiver is not able to get a differential solution position. The checkbox is associated with the receiver parameter **/par/pos/mode/sp**.

At the present time, the checkboxes **Code Differential**, **Phase Float** and **Phase Fixed** are unavailable and being checked at the same time demonstrating that these solution types are also enabled.

RTK Parameters

The **RTK mode** radio button group serves to toggle between the *extrapolation* and *delay* modes. If **Extrapolation** is selected, the rover will extrapolate the base station's carrier phase measurements when computing the rover's current RTK position. If **Delay** is selected, the rover *will not* extrapolate the base station's carrier phase measurements to compute the current rover position. Instead, the RTK engine will compute either a delayed RTK position (for

the epoch to which the newly received RTCM/CMR message corresponds) or the current stand-alone position (while waiting for new RTCM/CMR messages coming from the base). These radio buttons relate to the receiver parameter **/par/pos/pd/mode**.

To define the rover dynamics, use the **Dynamics** radio button group. The corresponding parameter is **/par/pos/pd/dyn**.

The **Ambiguity Fixing Level** radio buttons govern the process of the RTK engine fixing integer ambiguities. The RTK engine uses the *ambiguity fix indicator* when making decision whether to fix ambiguities or not. **Low**, **Medium** and **High** correspond to the indicator's 95%, 99.5% and 99.9% states, respectively. The higher the specified confidence level, the longer the integer ambiguity search time. This is the price we have to pay for the higher reliability of the ambiguity fixed solution. These buttons are associated with the receiver parameter **/par/pos/pd/aflevel**

The **Measurements Used** checkbox group allows the user to select measurement types used by the rover for position computation. The checkbox **CA/L1** corresponds to the receiver parameter **/par/pos/pd/meas/ca**, the control **P/L1** corresponds to the receiver parameter **/par/pos/pd/meas/p1**, the control **P/L2** is associated with the receiver parameter **/par/pos/pd/meas/p2**.

In the **Base Corrections period** edit box, the user can set the differential correction update interval. It should be noted here that the user must know the exact rate at which the reference station broadcasts its differential correction data. This edit box corresponds to the receiver parameter **/par/pos/pd/period**.

The receiver will use the control **Base Corrections period** only if it runs in **Delay** mode. Also, this edit box is used to provide more reliable synchronization between the base station and rover.

If you set the checkbox **Use old ref. Coordinates** to **ON** and then launch RTK, the rover receiver immediately starts using the existing reference coordinates in place of expecting when the reference station transmits some updated reference coordinates to the rover side.

The checkbox relates to the receiver parameter **/par/pos/pd/ref/keep**.

Care should be taken when setting this parameter to **ON**. Imagine for a moment that the rover has changed the location and started a new RTK session with a different reference station. Should this parameter be set to **ON**, the rover receiver will be misusing the *old* reference coordinates for some time, which will most likely result in position blunders until the rover receives a first message with the correct reference coordinates.

The list box **Source** serves to specify the source (port) from which the receiver will use differential data for position computation in RTK mode. This list box is associated with the receiver parameter **/par/pos/pd/port**.

CMR Settings

With the **GLONASS message** spin box the user assigns the message type for GLONASS measurements. Make sure that both the reference station and rover receiver use the same

message type for GLONASS measurement data. The spin button is associated with the receiver parameter **/par/cmr/rover/glo/type**.

Press the **Reset RTK Engine** button to reset the RTK engine. It means that all of the previously obtained estimates (estimated position, variance-covariance matrix, etc.) will be thrown away and the RTK engine will then start "from scratch". The button corresponds to the receiver parameter **/par/pos/pd/reset**.

To access the tab allowing you to revise and edit port settings, either click the **Ports** tab, or press the **Configuration of Receiver Ports** button.

4.2.4.6. Ports

With this tab the user can specify all necessary settings for serial ports A, B, C D, parallel port and internal modem. The tab is subdivided into three subtabs (Figure 34).

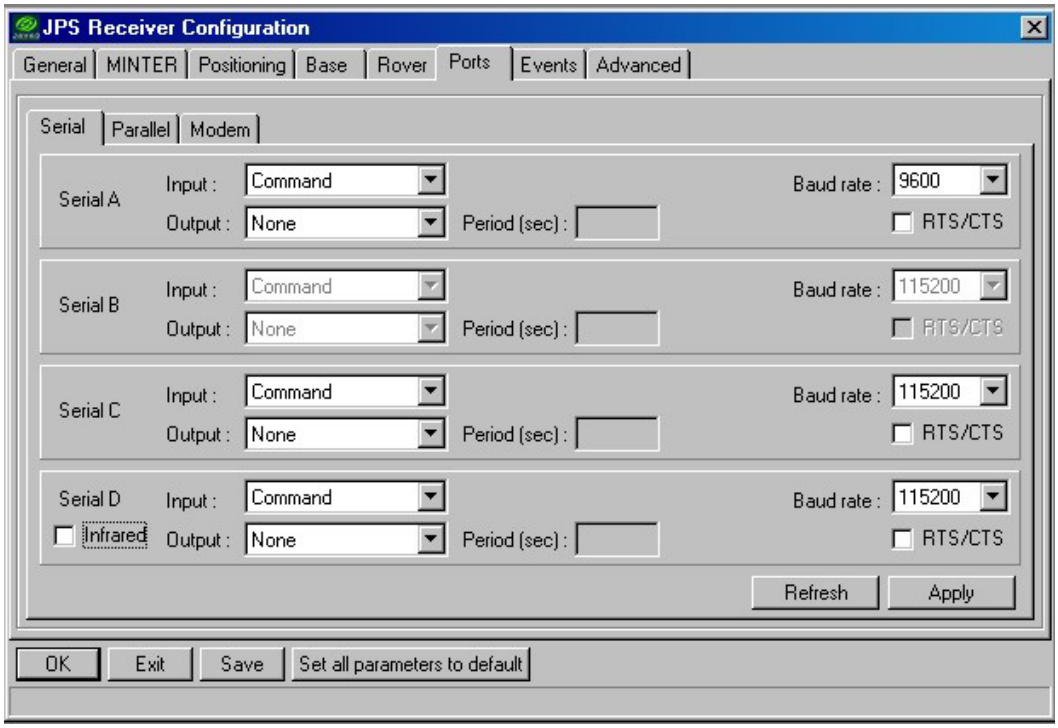


Figure 34. "Ports" tab

Serial

Use this subtab to control the settings for serial ports A, B, C and D (see Figure 34).

The list box **Input** allows the user to specify what incoming data types the corresponding port is tuned for:

- **None** – means that the port will neglect any incoming data.
- **Command** – the port is in command mode. In this mode the port recognizes the commands sent by the user.
- **Echo** – the port is in echo mode. Being used in this mode the receiver port redirects all incoming data to an "output stream". Note that "output stream" may be either a port or the current logfile
- **RTCM** – the port is in RTCM input mode.

- **CMR** – the port is in CMR input mode.

This list box corresponds to the receiver parameter **/par/[port]/imode**.

The list box **Output** allows the user to specify what outgoing data types the corresponding port is tuned for:

- **None** – the port outputs nothing.
- **DGPS full output** – the port outputs RTCM message types 1, 31.
- **DGPS partial output** – the port sends RTCM message types 9, 34.
- **RTK RTCM output** – the port issues RTCM message types 18, 19, 22, 3.
- **RTK CMR output** – the port sends CMR message types 10[21], 0, 1.
- **User Defined** – the port outputs data specified by the user. It means that the user defined some arbitrary message set that will be outputted through the port.

In the **Period** edit box the user sets the message output interval (in seconds).

It is worth noting, however, that the period of RTCM messages types 22, 3 and CMR message type 1 cannot be changed with this edit box. The default period for the mentioned messages is 10 s. If you want to vary the period, you should use the **em** command from the **Manual Mode** window. For more details on **em** refer to the GRIL manual.

If you set an incorrect message output interval (the **Period** edit box), PC-CDU will run a utility called **Output Period Setup Wizard**. For more information on the Wizard, see Appendix B. Output Period Setup Wizard.

To set the baud rate for the corresponding receiver port, use the **Baud rate** list box. The list box is associated with the receiver parameter **/par/[port]/rate**.

The checkbox **RTS/CTS** enables/disables hardware handshaking for the port. The checkbox is associated with the receiver parameter **/par/[port]/rtscts**.

In addition to described settings, port D has a unique checkbox **Infrared** that permits the user to configure this port as infrared device. The checkbox relates to the receiver parameter **/par/[port]/ir**.

Use **Infrared** mode only if the following conditions are met:

- A device you are going to connect to is compatible with the receiver infrared interface (for example, CDU-1).
- Your receiver supports the infrared port hardware-wise.
- The option **Infrared Port** is enabled in your receiver.

---

[21]) This message type has been developed by JNS to overcome some limitations existing in the original CMR protocol.

Parallel

These settings are similar to ones in the **Serial** tab except for the fact that the settings design to control parallel port (Figure 35).

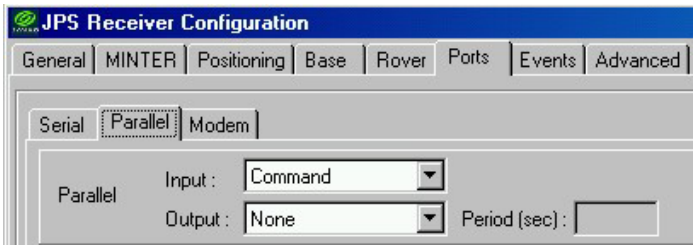


Figure 35. "Parallel" subtab

Modem

Should you have an internal modem installed, use the controls in this subtab (Figure 36).

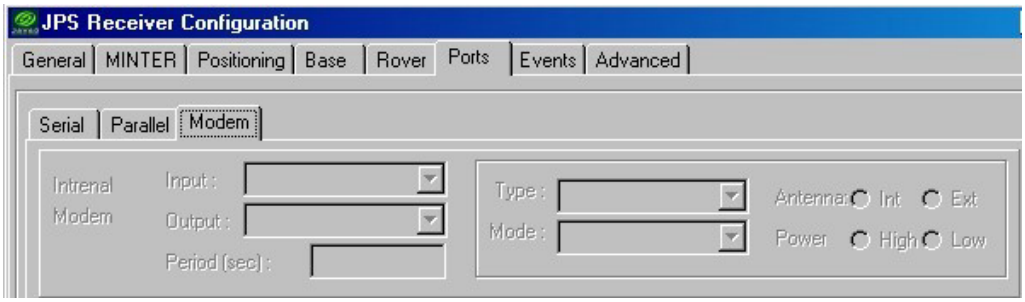


Figure 36. "Modem" subtab

Internal Modem

Input, **Output** and **Period** are similar in their purposes to the analogous settings in the **Serial** and **Parallel** subtabs.

The **Type** list box allows the user to set operation modes (**Receiving** or **Transmitting**).

The **Mode** list box intends to specify the method used to transmit data:

- **Off** – internal modem is turned off.
- **FHSS** – internal modem uses frequency-hopping spread spectrum technique.
- **DSS** – internal modem uses direct-sequence spread spectrum technique.

These list boxes are associated with the receiver parameter **/par/dev/modem/a/type.**

With the **Antenna** radio buttons, the user sets the antenna type the modem uses. **Int** stands for an internal antenna. **Ext** stands for an external antenna. The radio buttons correspond to the receiver parameter **/par/dev/modem/a/ant.**

You can set power transmitting mode for the internal modem using the **Power** radio buttons. The radio buttons are associated with the receiver parameter **/par/dev/modem/a/pwr.**

4.2.4.7. Events

This tab (Figure 37) is used to review and configure the 1PPS signal and Event marker settings.

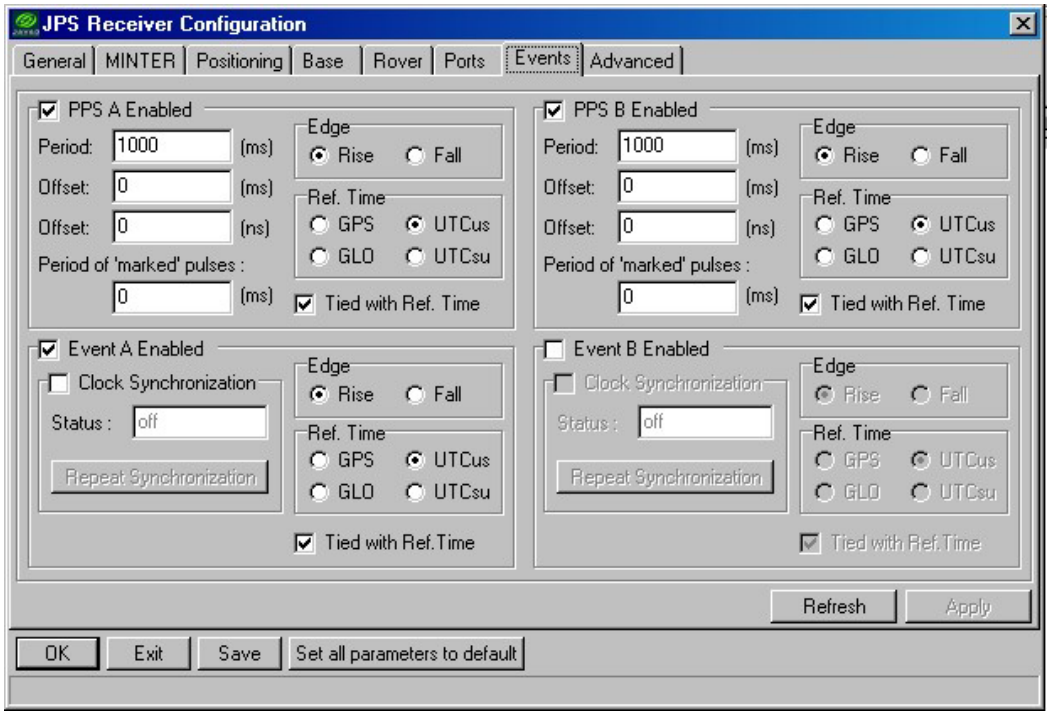


Figure 37. "Events" tab

The checkboxes **PPS A Enabled** and **PPS B Enabled** correspond to the receiver parameters **/par/dev/pps/a/out** and **/par/dev/pps/b/out,** respectively. Selecting these controls, you enable the receiver to generate 1PPS signals and also you will be able to modify the settings related to the selected 1PPS signal.

The **Period** edit box determines the rate of generating the 1PPS signals via the corresponding output connector pins. The edit boxes are associated with the receiver parameters **/par/dev/pps/a/per/ms** and **/par/dev/pps/b/per/ms,** respectively.

The user can determine millisecond and nanosecond parts of PPS signal offsets with respect to the selected reference time grid using the **Offset (ms)** edit box for millisecond part and **Offset (ns)** for nanosecond part. These four edit boxes are associated with the receiver parameters **/par/dev/pps/a/offs/ms, /par/dev/pps/b/offs/ms, /par/dev/pps/a/offs/ns** and **/par/dev/pps/b/offs/ns,** respectively.

With the **Period of 'marked' pulses** edit box, the user specifies the period of the marked 1PPS signal. These edit boxes relate to the receiver parameters **/par/dev/pps/a/mper** and **/par/dev/pps/b/mper.**

Using the **Edge** radio button group, the user synchronizes the edge (rising or falling) of the 1PPS signal with the specified reference time. The radio buttons are associated with the receiver parameters **/par/dev/pps/a/edge** and **/par/dev/pps/b/edge.**

The **Ref. Time** radio button group allows the user to select the reference time that the 1PPS signal will be synchronized with. There are four available reference time scales:

- GPS means GPS system time.
- GLO means GLONASS system time.

- UTCus means UTC(USNO).
- UTCsu means UTC(SU).

These radio buttons are associated with the receiver parameters **/par/dev/pps/a/time** and **/par/dev/pps/b/time**, respectively.

If the user selected the **Tied with Ref. Time** checkbox, the receiver will synchronize the 1PPS signal with the chosen reference time. Otherwise, 1PPS will be synchronized either with the receiver's internal clock or with an external frequency (in the latter case the parameter **/par/frq/input** must be set to **ext**).

In order to enable or adjust the event input function, use the controls described below.

The checkboxes **Event A Enabled** and **Event B Enabled** correspond to the receiver parameters **/par/dev/event/a/in** and **/par/dev/event/b/in**, respectively. With these controls, the user enables the receiver to measure and log event times in the specified reference time with high accuracy.

If the **Clock Synchronization** checkboxes is selected, the receiver carries out one-time synchronization its one-millisecond cycle grid with the corresponding edge of the event signal. These checkboxes are associated with the receiver parameters **/par/dev/event/a/lock** and **/par/dev/event/b/lock**, respectively.

The **Status** indicator shows whether the receiver clock is actually being synchronized with the event signals or not. If you see **on** in the field, it means the synchronization has been done successfully. These fields relate to the receiver parameters **/par/dev/event/a/locked** and **/par/dev/event/b/locked**, respectively.

In some cases, however, it can be necessary to perform the synchronization again. For this purpose click the **Repeat Synchronization** button several times until **on** appears.

The **Rise** and **Fall** radio buttons serve to measure the time of either the rising edge or falling edge of the input event signal. These radio buttons correspond to the receiver parameters **/par/dev/event/a/edge** and **/par/dev/event/b/edge**, respectively.

The **Ref. Time** radio button group sets the reference time scale that the event reception time will be synchronized with. These radio buttons are associated with the receiver parameters **/par/dev/event/a/time** and **/par/dev/event/b/time**.

With the **Tied with Ref. Time** checkboxes, the receiver is instructed to measure the event reception time in the selected reference time with or without consideration for the computed receiver clock offset. These checkboxes relate to the receiver parameters **/par/dev/event/a/tied** and **/par/dev/event/b/tied**, respectively.

4.2.4.8. Advanced

The **Advanced** tab is composed of six subtabs, as illustrated in Figure 38.

Warning! Only change these advanced settings when you know what they mean. Unsuitable changes to these subtabs can cause the receiver to run improperly. If you are doubtful of any changes you made to these subtabs, you can always get the factory default settings back by pressing the **Set all parameters to defaults** button. For a description of these subtabs refer to the corresponding paragraphs below.

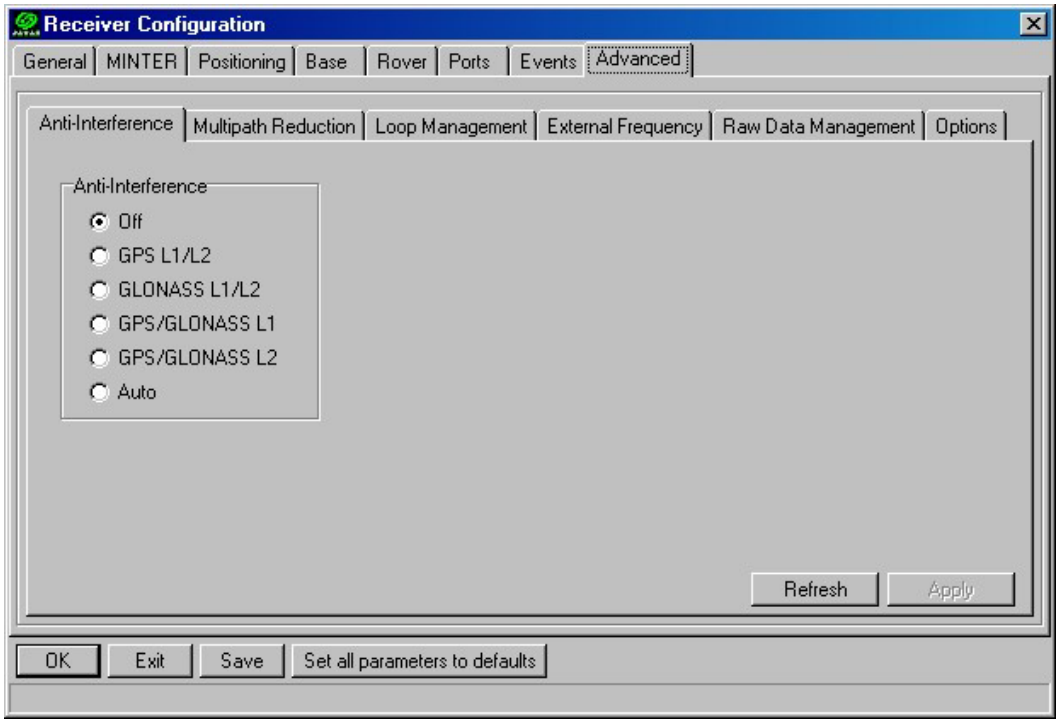


Figure 38. "Advanced" subtab

Anti-Interference

With the **Anti-Interference** radio button group (Figure 38), the user enables mode allowing the JNS receivers to suppress the impact of narrow-band interferences. The user can assess the presence of interference based on the following information:

- When the number of tracked satellites is fewer (by 2 or greater) than the number of satellites in view;
- When the signal-to-noise ratio (C/N0) in the C/A channel for the satellites having elevations above 30 degrees does not exceed 40 dBHz;
- When the information about interferences indicates that Jamming Suppressor detected interference signals within the specified band and also the strength of aggregate in-band interference is characterized as high or hard. This information you can obtain with the command **em,,jps/JI**.

This radio button group is associated with the receiver parameter **/par/ajm/mode**.

Multipath Reduction

The checkboxes **Code multipath reduction** and **Carrier multipath reduction** (Figure 39) are used for mitigating multipath.

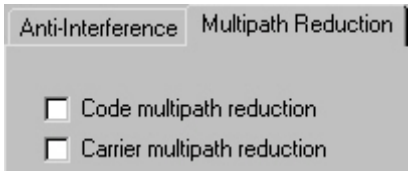


Figure 39. "Multipath Reduction" tab

When the reference station and rover station run in DGPS mode and they are not free from the impact of multipath, we recommend that you select the **Code multipath reduction** checkbox for both the reference and rover stations. This checkbox is associated with the receiver parameter **/par/raw/corr/ca/code**. If you use a pair of receivers in RTK mode, select the checkbox **Carrier multipath reduction** for both receivers. The checkbox is associated with the receiver parameter **/par/raw/corr/ca/carrier**.

Loops Management

In this subtab the user can configure the settings that deal with the receiver capability of searching, acquiring and tracking the GNSS satellite signals (Figure 40).

Care should be taken when changing the settings for this subtab. An improperly set control may result in receiver malfunction. We recommend that you do not change these settings without good reason. For an explanation of this subtab, please see details under figure 40.

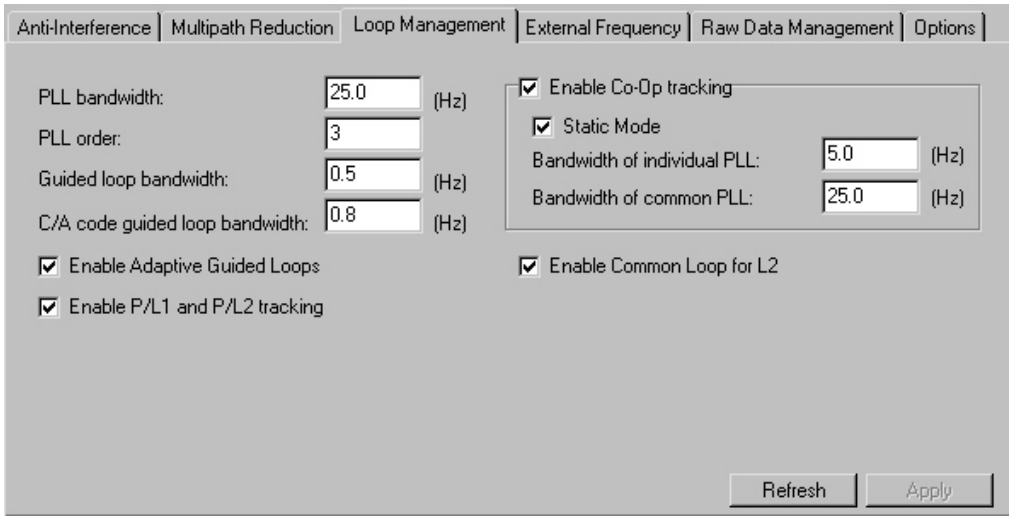


Figure 40. "Loops Management" subtab

The **PLL bandwidth** edit box governs the noise bandwidth of the guiding phase lock loops. The edit box is associated with the receiver parameter **/par/raw/pll/band**. In this box, you can enter values between 2 and 50 Hz.

With the **PLL order** edit box, the user can toggle guiding and common lock loop order between 2 and 3. Care should be taken when using 2nd order PLL because this can adversely af-

fect satellite signal tracking in some cases. The edit box relates with the receiver parameter **/par/raw/pll/order**.

The **Guided loop bandwidth** edit box governs all of the "guided" loops but the C/A DLLs. Here you can enter values between 0.1 Hz and 10 Hz. The edit box is associated with the receiver parameter **/par/raw/gdl/band**.

The **C/A code guided loop bandwidth** edit box specifies the bandwidth of the receiver's C/A group delay lock loop. In this box, you can enter the values between 0.1 Hz and 50 Hz. The edit box relates to the receiver parameter **/par/raw/cagdl/band**.

With the **Enable Adaptive Guided Loops** checkbox, you enable/disable the use of adaptive guided loops. If you select the checkbox, the receiver will adjust the guided loops bandwidths depending on the actual strengths of the signals tracked. The weaker the signals, the narrower the bandwidths. The checkbox corresponds to the receiver parameter **/par/raw/gdl/adapt**.

With the **Enable P/L1 and P/L2 tracking** checkbox you can adjust tracking settings for the receiver. If you have either a single-frequency receiver or L1 only antenna, it is recommended to disable tracking of the P/L1 and P/L2 signals. The checkbox is associated with the receiver parameter **/par/lock/pcode**.

The checkbox **Enable Co-Op tracking** is associated with the receiver parameter **/par/raw/clp/loops**. Select the checkbox to enable mode and make the other controls in the group available for modifying. Co-Op tracking mode is used to considerably improve the tracking characteristics of JNS receivers.

- When the receiver is in Co-op tracking mode, you can enable the **Static Mode** checkbox. This mode allows the receiver to acquire satellites with lower signal-to-noise ratios and reduce the reacquisition time for the satellite signals after a temporary loss of lock. The **Static Mode** checkbox is associated with the receiver parameter **/par/raw/clp/static**.

The receiver will take the above-described parameter into consideration only if the receiver antenna is stationary and **Enable Co-Op tracking** is selected.

- The **Bandwidth of individual PLL** and **Bandwidth of common PLL** edit boxes mean exactly what their names imply:
  - **Bandwidth of individual PLL** is associated with the receiver parameter **/par/raw/clp/indband;**
  - **Bandwidth of common PLL** is associated with the receiver parameter **/par/raw/clp/comband**.

Select the **Enable L2 common loop** checkbox to avoid the loss of L2 phase tracking in dynamic applications due to antenna rotation around its axis. The checkbox corresponds to the receiver parameter **/par/raw/clp2/loop**.

External Frequency

The settings on this subtab (Figure 41), allow you to configure the use of reference frequency (it may be either high-stability external frequency or the receiver's internal crystal oscillator).

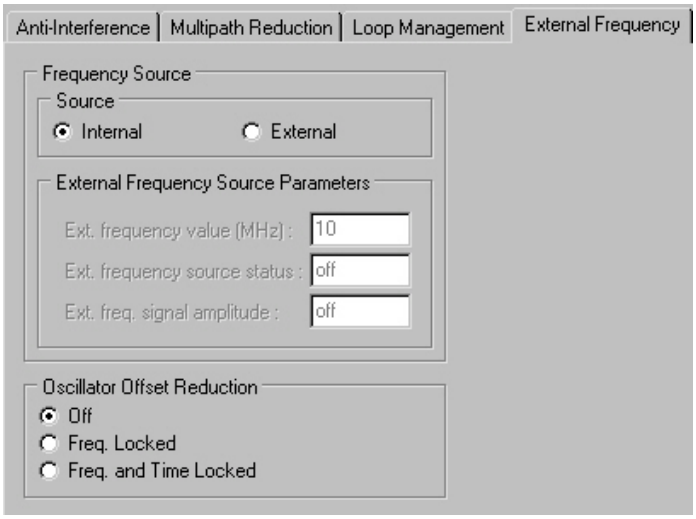


Figure 41. "External Frequency" subtab

With the controls in the **Source** group, the user specifies the reference frequency input that the receiver will use:

- **Internal** – means the receiver uses the internal oscillator.
- **External** – means the receiver uses an external frequency.

These radio buttons are associated with the receiver parameter **/par/frq/input.**

Switching from **Internal** to **External** and vice versa may result in a temporary loss of lock to satellites.

The **External Frequency Source Parameters** controls allow the user to adjust the parameters related to external frequency mode:

- With the **Ext. frequency value** edit box you specify nominal external frequency value. Here you can enter the values between 2 and 40 MHz. The default value is 10 MHz. The box is associated with the receiver parameter **/par/frq/ext.**
- The field **Ext. frequency source status** shows whether the external frequency is being used or not:
  - **off** – indicates that the receiver is using the internal crystal oscillator.
  - **wait** – indicates that the receiver is waiting for the external frequency lock. More precisely, this value will be returned in the following three cases:
    1. If the external frequency oscillator is disconnected;
    2. If the amplitude of input signal is too low;
    3. If the actual external frequency is different from that specified in the **Ext. frequency value** edit box.
  - **locked** – indicates that the receiver is using the external frequency.

  The field is associated with the receiver parameter **/par/frq/stat.**
- With the **Ext. freq. signal amplitude** field the user can estimate the external frequency signal amplitude:

- **off** – indicates that the internal oscillator is actually being used;
- **low** – indicates that the external frequency signal's amplitude is lower than needed;
- **ok** – indicates that the external frequency signal's amplitude meets the specs.

This field correspond to the receiver parameter **/par/frq/amp**.

The **Oscillator Offset Reduction** group box allows the user to govern the behavior of the internal crystal oscillator.

- The **Off** radio button means that oscillator frequency offset reduction mode is turned off.
- The **Freq. Locked** radio button means that the receiver will adjust the internal oscillator's frequency until the measured frequency offset is reduced to zero. By using the incoming satellite signals, the receiver will force the internal oscillator to generate a very stable 20 MHz frequency signal. This frequency output is available via the corresponding receiver output pin.

The user is able to monitor the offset reduction in the **Clock offset** field of the **GEO** tab. After you select **Freq. Locked**, you will notice that the value in **Clock offset** will have started to reduce and pretty soon (usually in a few minutes) it will become equal to zero, while in contrast **Osc. Offset** will not change much.

- The **Freq. and Time Locked** radio button means that the receiver will adjust both the internal oscillator's frequency until the measured frequency offset is reduced to zero and the internal clock until it gets fully synchronized with the specified reference time scale.

Switching from **Freq. Locked** or **Freq. and Time Locked** to **Off** may result in a temporary loss of lock to satellites.

Freq. Locked guarantees that the receiver's 20 MHz output will have high long-term stability, not necessary high short-term stability. However, there is a way to assure that both of these characteristics will be good enough. It can be done by selecting **Enable Co-op tracking** on the **Loops Management** subtab.

The radio buttons are associated with the receiver parameter **/par/osc/mode**.

Raw Data Management

This subtab, which is shown in Figure 42, contains the controls for specifying the frequency at which the receiver will update raw measurement and position. Also, you may set up the controls that affect the signal processing.

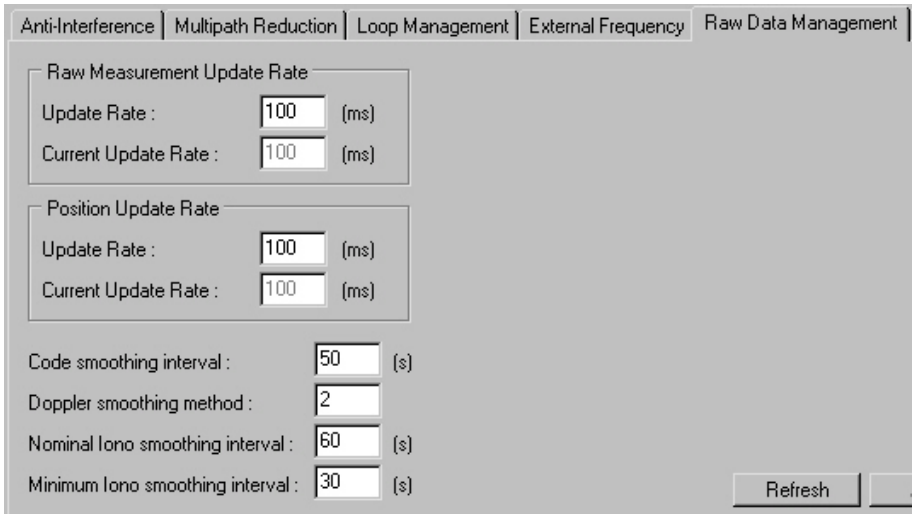


Figure 42. "Raw Data Management" subtab

The **Raw Measurement Update Rate** group allows the user to determine the raw data update period. In the **Update Rate** edit box, enter a value (in milliseconds) to specify the period. The box corresponds to the receiver parameter **/par/pos/raw/msint**. With **Current Update Rate**, you can check which period is actually being used by the receiver. This filed corresponds to the receiver parameter **/par/raw/curmsint**.

The **Position Update Rate** group allows the user to determine the receive position update period. In the **Update Rate** edit box, enter a value (in milliseconds) to specify the period. The edit box is associated with the receiver parameter **/par/pos/msint**. With **Current Update Rate**, you can check which period is actually being used by the receiver. This field is associated with the receiver parameter **/par/pos/curmsint**.

When you open a file, regardless of whether this operation was done from the **Real-time logging** window or the **File Manager** window, and the recording interval had an incorrect value, PC-CDU launches a utility called **Output Period Setup Wizard**. For more information about the Wizard, see Appendix B. Output Period Setup Wizard.

The **Code smoothing interval** edit box, which is associated with the receiver parameter **/par/raw/smi**, specifies the interval over which pseudoranges are smoothed by using corresponding carrier phase measurements. Here you can enter values between 0 and 900 seconds. Zero designates that carrier phase measurements will not be used for smoothing pseudo-ranges.

In the **Doppler smoothing method** edit box, the user sets the method used for smoothing Doppler. There are three available methods:

- **0** - Receiver outputs raw (unsmoothed) Doppler. Instantaneous yet rather noisy Doppler measurements.
- **1** - Doppler is computed using two consecutive carrier phase measurements, *CarPhase[i]* and *CarPhase[i-1]*, where *i* stands for the current epoch. Such Doppler measurements are less noisy than in the first case.

- **2** - Doppler is computed using only three consecutive carrier phase measurements, *CarPhase[i]*, *CarPhase[i-1]* and *CarPhase[i-2]*, where *i* stands for the current epoch. Doppler measurements obtained in this mode are least noisy.

The edit box is associated with the receiver parameter **/par/raw/dopp/smi**.

With **Nominal Iono smoothing interval** edit box, the user specifies the *nominal* ionospheric correction smoothing interval over which raw ionospheric corrections are smoothed (assuming the receiver has been working for some time and has already obtained enough raw ionospheric corrections to perform such smoothing). This integer parameter varies between 0…900 seconds. The default value is 60. The edit box is associated with the receiver parameter **/par/raw/iono/smi**.

With the **Minimum Iono smoothing interval** edit box, the user specifies the *minimum* smoothing interval for the receiver to filter raw ionospheric corrections before they can be used in position computation. This integer parameter ranges between 0 and 900 seconds. The default value is 30 seconds. The edit box relates to the receiver parameter **/par/raw/iono/minsmi**.

Options

Figure 43 shows the subtab from which the user can turn on/off the Cinderella option. Every other Tuesday, Cinderella enables the receiver to run as a dual-frequency GPS+GLONASS unit during 24 hours. For information on scheduling *Cinderella Tuesdays*, visit the Cinderella Option page on the JNS web site at http://www.javadgps.com/jns/technology/Cinderella%20Option.html. These radio buttons are associated with the receiver parameter **/par/opts/cind**.

Figure 43. "Options" subtab

4.2.5. Site Configuration window

To open the **Site Configuration** dialog window, select the **Site** item from the **Configuration** menu, or press the keys **CTRL+I**.

This window serves the same purposes as the **Site Configuration** window described in 4.2.1.2.

4.2.6. Target Position window

To go to the **Target Position** window, either select the **Target Position** from the **Configuration** menu, or press the keys **CTRL+T**.

Target coordinates that the user enters here (Figure 44) will then be shown in the **Lat** and **Lon** fields of the **Target** tab. Pressing the **Get from receiver** button will instruct PC-CDU to set the target position equal to the receiver's current position.

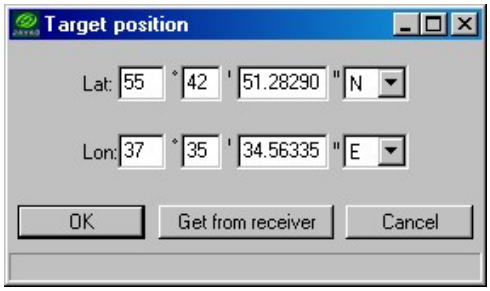


Figure 44. "Target Position" window

4.2.7. RFM96 Configuration window

To open the **RFM96 Configuration** window, select the **Radio** item from the **Configuration** menu, then click **RFM96**, as shown in Figure 45.

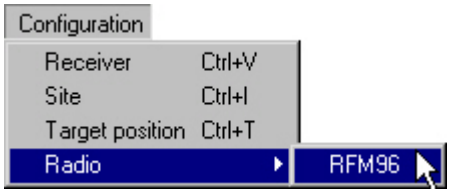


Figure 45. RFM96 item

Figure 46 shows the tab that will appear after you click the **RFM96** item.

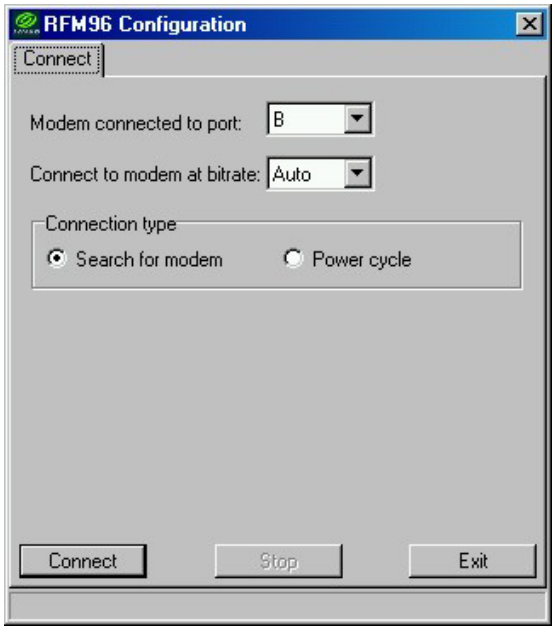


Figure 46. "Connect" tab

This tab allows the user to establish communication with the radio modem.

Use the **Modem connected to port** list box to select the receiver port that the radio modem is connected to. Normally, this is port C for the Legacy, Legacy-GGD, Legacy-GD(GG), Regency, HiPer, Prego and port B for the Odyssey.

To set the baud rate that the modem communicates to the receiver at, use the **Connect to modem at bitrate** list box. It is normally 38400 bps. If you want the receiver automatically detects the baud rate, select **Auto**.

Next, select the method of modem connection. For most RFM96 models, you can use **Search for modem**.

If the radio is not found, change **Connection type** to **Power cycle** and press **Connect**. The program will prompt you to turn the modem **OFF** and then back **ON** (Figure 47). The program will poll the radio during its power up cycle and establish a connection. If you have an older RFM96, then start with the radio's power off, use the **Power cycle** type and, when prompted, connect power to the radio.

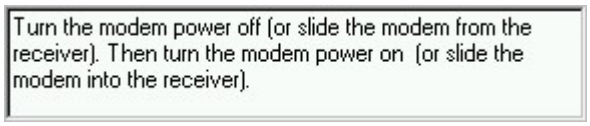

Turn the modem power off (or slide the modem from the receiver). Then turn the modem power on (or slide the modem into the receiver).

Figure 47. Operations the user should take in Power cycle mode

After you make any required changes, click the **Connect** button to activate your changes and connect to the modem with the new settings.

After a connection with the modem is established, you will see a dialog window showing the radio link settings and protocol details (Figure 48).

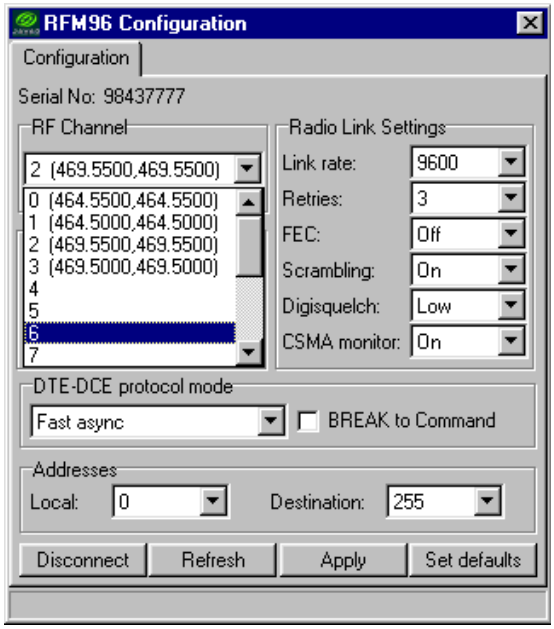


Figure 48. "Configuration" tab. PDL configuration settings

In the **RF Channel** list box the user can choose the desired channel. Once the change has been made, press the **Apply** button to program the radio.

Be very careful to let the program complete its programming cycle and then press **Disconnect**. Any interruption in power can cause the radio to lose its memory map. If this happens, contact JNS support or Pacific Crest support.

The settings, shown in Figure 49, are the only settings that work reliably with the RFM radio. However, if you made any changes, press the **Apply** button to confirm the changes.

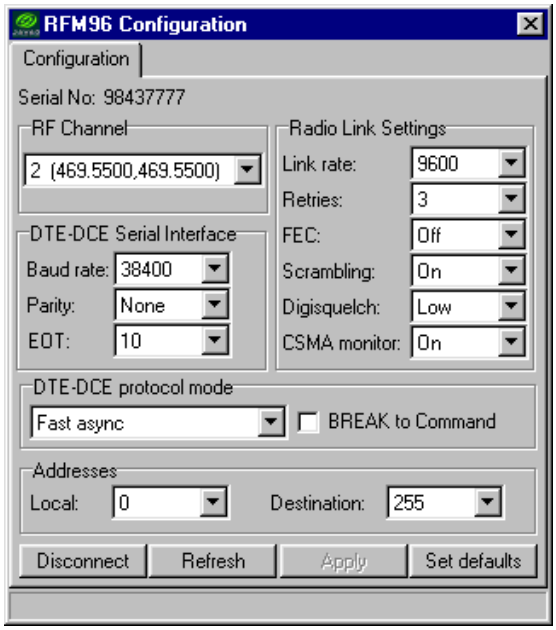


Figure 49. "Configuration" tab. Recommended settings.

Pressing the **Set defaults** button returns all radio link and serial interface settings back to their factory default values.

Digisquelch should be set to **Low** on the base and **High** on the rover. If the radio at the rover is receiving external interference, then you should set it to **Medium** or **Low**.

4.2.8. Initialize file system

To initialize the file system in the connected receiver, select the **Initialize file system** item from the **Tools** menu.

This procedure is to some extent similar to disk formatting. It results in erasing all of the files inside the receiver. After pressing **Initialize file system**, you will be prompted to confirm the command (Figure 50). In practice, you do not execute this procedure very often.

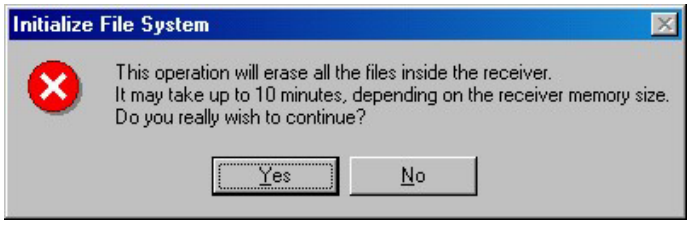

Initialize File System
This operation will erase all the files inside the receiver.
It may take up to 10 minutes, depending on the receiver memory size.
Do you really wish to continue?
Yes
No

Figure 50. "Initialize File System?" warning

Note that the command's execution time may be up to 10 minutes depending on the receiver's memory size.

4.2.9. Clear NVRAM

To clear NVRAM, select the **Clear NVRAM** item from the **Tools** menu.

The receiver's non-volatile RAM (NVRAM) keeps data required for satellites tracking, like ephemeris and receiver position. NVRAM also keeps the current receiver's settings like active antenna input, elevation masks, recording interval and information about the receiver's internal file system. Clearing NVRAM may help you solve existing problems with satellite tracking.

After clearing the NVRAM, your receiver will require some time to re-collect the new ephemerides and complete almanacs (around 15 minutes).

Clearing the NVRAM sets all receiver parameters back to their factory default values. Care should be taken that after clearing the NVRAM these parameters are set correctly. PC-CDU will prompt you to check these settings by opening the **Receiver Configuration** dialog window.

In addition, the NVRAM is used to keep information about the receiver file system. Note that after clearing the NVRAM the receiver's FN LED will flash yellow for a few seconds indicating that the receiver is scanning/checking the file system.

4.2.10. Reset receiver

To reset the receiver, select the **Reset receiver** item from the **Tools** menu.

This operation is similar to computer resetting. It will not clear the receiver's NVRAM. When clicking the **Reset receiver** option, you will be prompted to confirm your command (Figure 51).

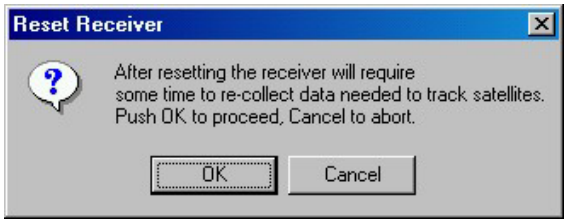

Reset Receiver
After resetting the receiver will require some time to re-collect data needed to track satellites. Push OK to proceed, Cancel to abort.
OK
Cancel

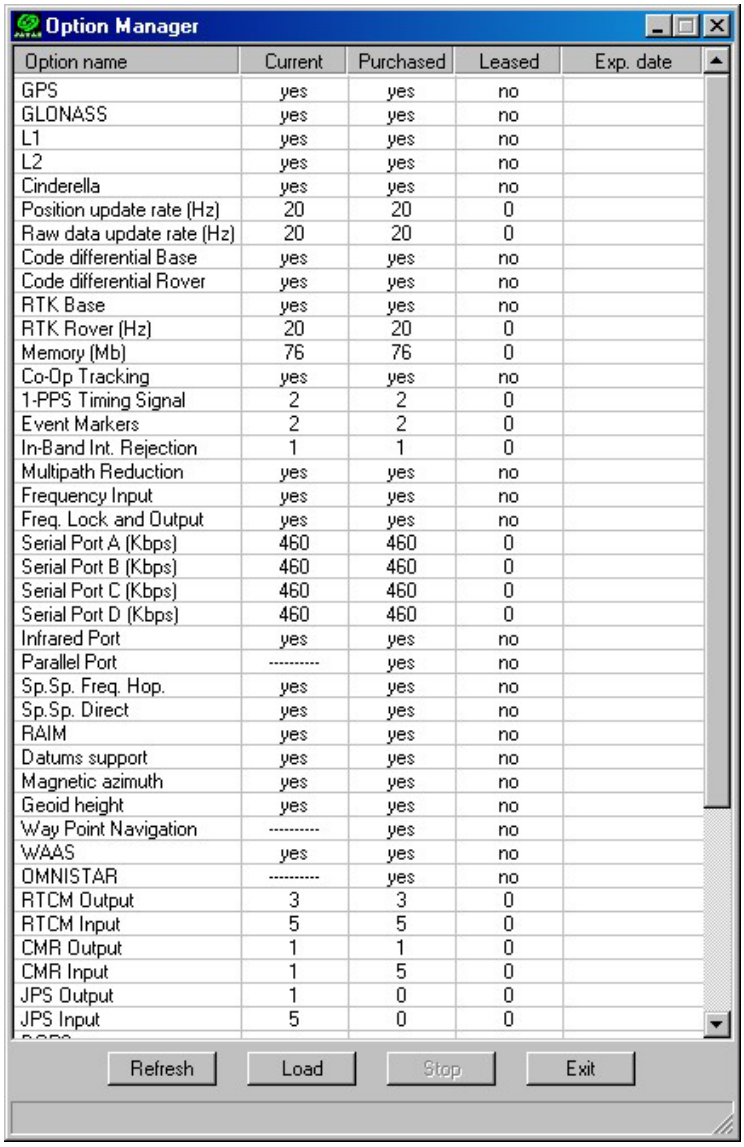
Figure 51. "Reset receiver?" warning

After the command is executed, PC-CDU disconnects itself from the receiver and then opens the **Connection Parameters** dialog box prompting you to set necessary parameters to connect to the receiver again.

4.2.11. Option Manager window

To go to the **Option Manager** window, select the **Receiver options** item from the **Tools** menu.

After you click **Receiver options**, you will see a window that looks like Figure 52.



Option name	Current	Purchased	Leased	Exp. date
GPS	yes	yes	no	
GLONASS	yes	yes	no	
L1	yes	yes	no	
L2	yes	yes	no	
Cinderella	yes	yes	no	
Position update rate (Hz)	20	20	0	
Raw data update rate (Hz)	20	20	0	
Code differential Base	yes	yes	no	
Code differential Rover	yes	yes	no	
RTK Base	yes	yes	no	
RTK Rover (Hz)	20	20	0	
Memory (Mb)	76	76	0	
Co-Op Tracking	yes	yes	no	
1-PPS Timing Signal	2	2	0	
Event Markers	2	2	0	
In-Band Int. Rejection	1	1	0	
Multipath Reduction	yes	yes	no	
Frequency Input	yes	yes	no	
Freq. Lock and Output	yes	yes	no	
Serial Port A (Kbps)	460	460	0	
Serial Port B (Kbps)	460	460	0	
Serial Port C (Kbps)	460	460	0	
Serial Port D (Kbps)	460	460	0	
Infrared Port	yes	yes	no	
Parallel Port	----------	yes	no	
Sp.Sp. Freq. Hop.	yes	yes	no	
Sp.Sp. Direct	yes	yes	no	
RAIM	yes	yes	no	
Datums support	yes	yes	no	
Magnetic azimuth	yes	yes	no	
Geoid height	yes	yes	no	
Way Point Navigation	----------	yes	no	
WAAS	yes	yes	no	
OMNISTAR	----------	yes	no	
RTCM Output	3	3	0	
RTCM Input	5	5	0	
CMR Output	1	1	0	
CMR Input	1	5	0	
JPS Output	1	0	0	
JPS Input	5	0	0	

Figure 52. "Option Manager" window

This window serves two main purposes. First, it indicates which of the receiver options are available for your receiver. Second, this window allows you to update the receiver options by loading a new receiver option file (with the extension .jpo). After pressing the Load button, PC-CDU will prompt you to enter the name of the corresponding .jpo file. When the loading of the new receiver option file is over (in the status bar you will see the comment **Option loaded. You need to configure the receiver.**), click the **Refresh** button to refresh the list of available options.

4.2.12. Scatter window

To go to the **Scatter** window, select the **Scatter** item from the **Plots** menu.

This is a useful graphic feature allowing you to monitor the behavior/quality of the receiver trajectory/position (Figure 53).

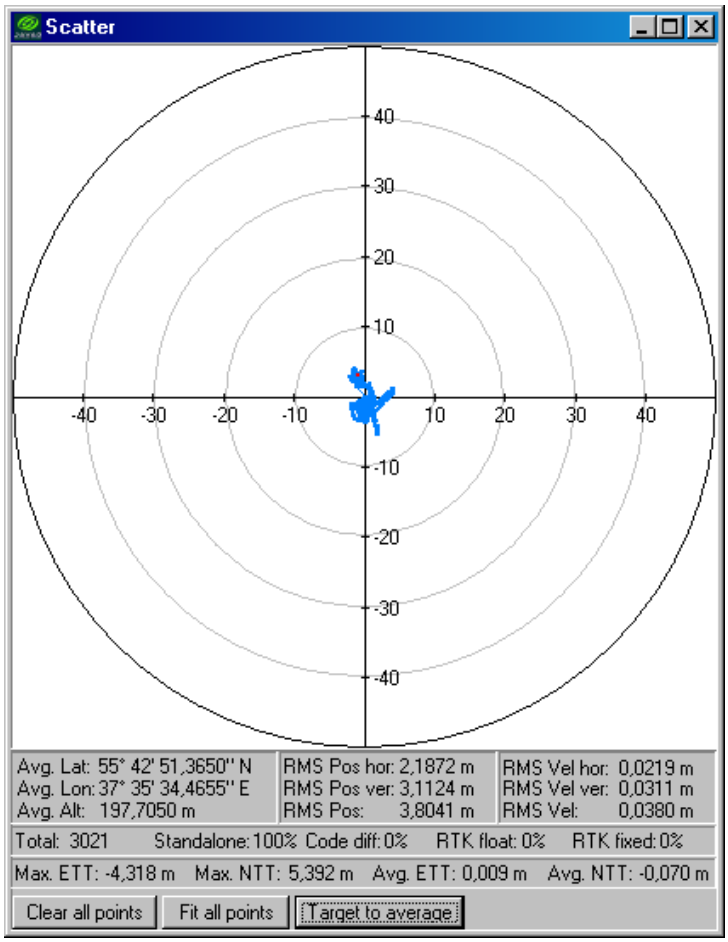


Figure 53. "Scatter" window

The window is divided into the scatter plot and an augmented status bar.

The plot displays the current receiver position relative to the position specified in the **Target position** window. The most current receiver position is showed by a red point.

Status bar contains the following information:

- average latitude, longitude and ellipsoidal height of the receiver's position over the entire set of obtained position estimates;
- horizontal position RMS error;
- vertical position RMS error;
- total position RMS error, i.e. the square root of the trace of the *position error* variance-covariance matrix;
- horizontal velocity RMS error;
- vertical velocity RMS error;
- total velocity RMS error, the square root of the trace of the *velocity error* variance-covariance matrix;

- the number of the position estimates for each of the four solution types (in %) and their total as well;
- the maximum and average *Easting to Target* and *Northing to Target* in the local system with the origin at the receiver.

Use the **Clear all points** button to erase all plotted points in the window.

When you press the button **Fit all points**, PC-CDU will automatically change the scale of the **Scatter** plot allowing you to view all positions, starting from the time PC-CDU established the connection to the receiver.

After you press **Target to average**, PC-CDU sets the target position equal to the average receiver's position.

If you close this window, the positions displayed in the **Scatter** plot and information in the status bar will not be discarded (unless you disconnect the receiver), thus when you reopen the window later, it will include both the current position information and data, beginning from the time you turned on PC-CDU.

4.2.13. Satellites window

To go to the **Satellites** window, select the **Satellites** item from the **Plots** menu.

The **Satellites** window shows graphic representation of the satellite positions in the sky (Figure 54).

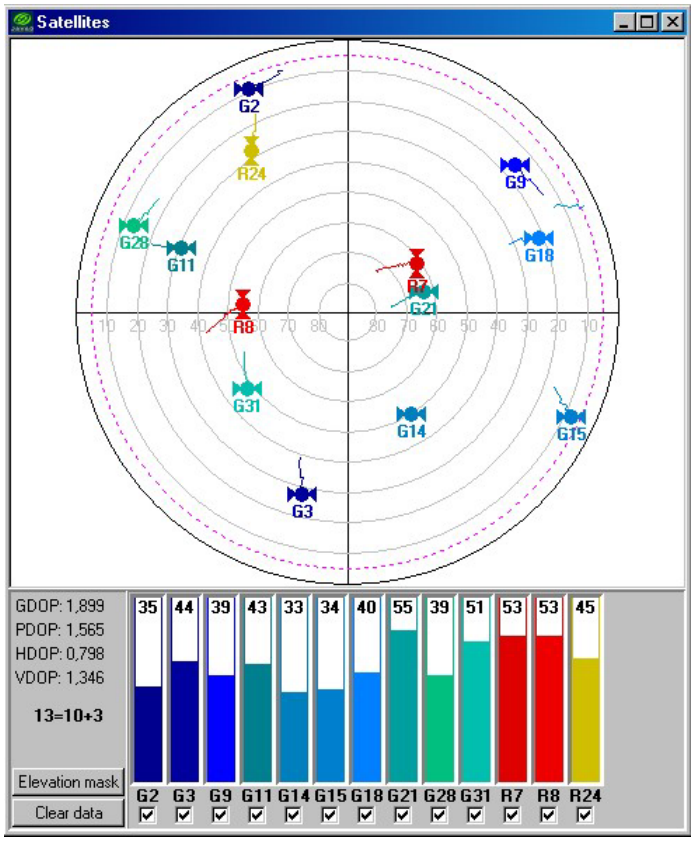


Figure 54. "Satellites" window

Each concentric circle represents the elevation angle above the horizon. The outermost circle corresponds to 0 degrees above the horizon. The center of the sky plot represents 90 degrees above the horizon. The dotted circle shows the elevation mask angle. In the figure above, the

mask angle equals 5 degrees. The user can adjust the mask angle through the **Elevation MaskForm** window which appears immediately after pressing the **Elevation mask** button. Also, the user can see four DOP characteristics, specifically:

- GDOP – Geometric (3 position coordinates plus clock offset in the solution);
- PDOP – Position (3 coordinates);
- HDOP – Horizontal (2 horizontal coordinates);
- VDOP – Vertical (height only).

A dynamically changing histogram shows the signal-to-noise ratio (C/N0) in the C/A channel. Each vertical bar has a unique color and designates a satellite's PRN (GPS and WAAS) or slot number (GLONASS). Note that GPS/WAAS and GLONASS satellites are marked with G# and R#, respectively. By selecting or clearing the checkbox for each SV, the user can specify which of the GPS, GLONASS and WAAS satellites are enabled/disabled for position computation.

To view the basic tracking information about a satellite, move the cursor onto the desired satellite's icon and right-click on it. Holding down the right button, you will see a pop-up window, as shown in Figure 55. The values in the window are similar to the values in **Main window** (see 4.1).

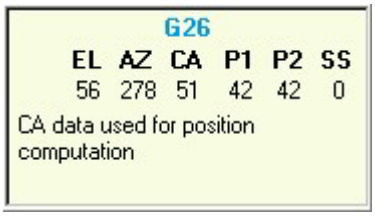


Figure 55. Pop-up menu, reflecting the information about the selected satellite

To clear the **Satellites** window, click the **Clear data** button

4.2.14. Position window

To go to the **Position** window, select the **Position** item from the **Plots** menu.

The graphs, in the **Position** window (see Figure 56), show the difference (in meters) between latitude/longitude of the current receiver position and latitude/longitude entered in the **Target position** window over the interval (in seconds) specified by the user in the **Plots Configuration** window.

The features of the graphs can be adjusted through the **Position** group box of the **Plots Configuration** window (see 4.2.15).

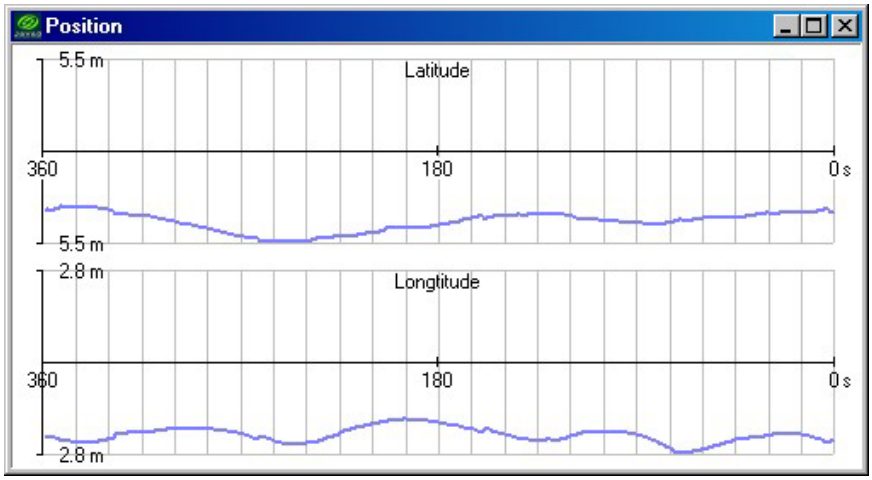


Figure 56. "Position" window

4.2.15. Plots Configuration window

To go to the **Plots Configuration** window, select the **Configuration** item from the **Plots** menu.

With this window (Figure 57), the user configures the settings in the **Scatter**, **Satellites** and **Position** windows.

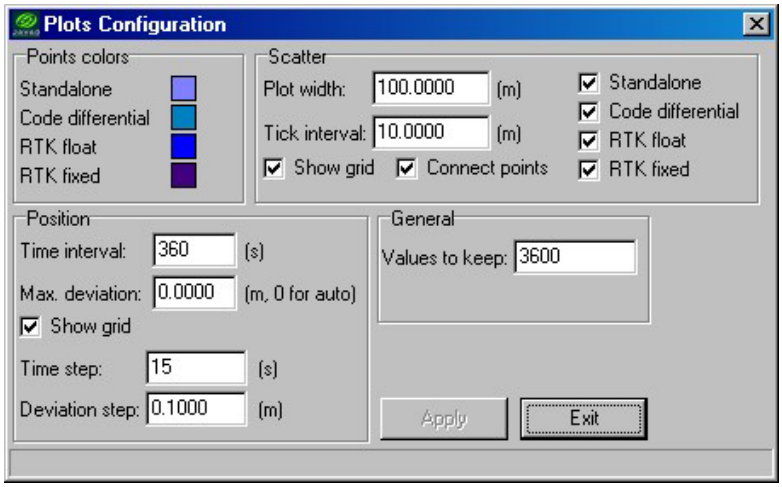


Figure 57. "Plots Configuration" window

To change the color for the points of the **Scatter** window, use the **Points colors** settings.

For example, if you want that the points, corresponding to the absolute position estimates, displayed in red, take the following steps:

1. Move the cursor onto the colored box, which is on the right side of **Standalone**.
2. Click either mouse button in a fill area of the box.
3. Click the color you want. If you do not see the color you want, click **Define Custom Colors>>**. To the right of **Basic colors** you will see a custom palette where you can mix your own color. After selecting the color you want, click **Add to Custom Colors**, and then click **OK**.

In the **Scatter** group box, the user can change the settings related to the **Scatter** window.

With the **Plot Width** edit box, the user specifies the length of the axes on the plot.

The **Tick Interval** edit box specifies the tick size (in meters) between the adjacent concentric circles (i.e. interval between adjacent values on the axis).

To remove the circle grid from the plot, clear the **Show grid** checkbox.

To link the points in the trajectory, select the **Connect points** checkbox.

With the checkboxes **Standalone**, **Code Differential**, **RTK float** and **RTK fixed**, you specify what kinds of solutions will be shown on this plot.

The **Position** group box contains the settings that govern the graphs in the **Position** window.

The edit box **Time interval** specifies the length of the x axis (in seconds).

The **Max. deviation** edit box specifies the length of the y axis (in meters).

To turn off the grid, clear the **Show grid** checkbox.

The **Time step** edit box specifies the time (in seconds) between adjacent vertical gridlines.

The **Deviation step** edit box sets the distance (in meters) between adjacent horizontal gridlines.

The **Values to keep** edit box determines the size of a circular buffer used to store the positions of the receiver's antenna. The default value is 3600. When the buffer is full, the new values overwrite the oldest. This circular buffer is used with the aim of saving the computer memory consumption when the graphs have been being monitored for a long time (continuously during several hours, days, etc.).

To commit any changes that you have made without closing the window, click **Apply**.

4.2.16. About PC-CDU

To access the **About PC-CDU** window, either select the **About** item from the **Help** menu, or press the keys **CTRL+U**.

The **About PC-CDU** window shows software version information and, after establishing connection, information about the receiver (Figure 58).

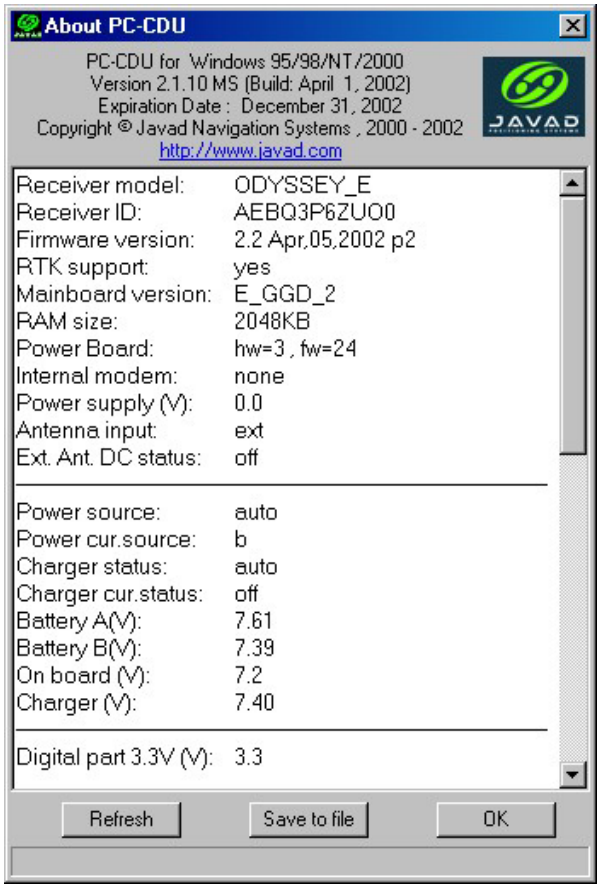


Figure 58. "About PC-CDU" window

PC-CDU retrieves the receiver ID and firmware version only if the connection to the receiver is established through the **Connection parameters** window. Should you replace one receiver with another improperly (i.e., without using the disconnect and connect commands), the **About PC-CDU** window will not reflect the parameters/status of the newly connected receiver correctly.

Bear in mind that Receiver ID is not the same as the receiver serial number printed on the receiver's body.

The **Save to file** button permits you to write the current receiver parameters and options into an ASCII file.

This file helps us find out the source of the problem, and then remedy it. Before contacting JNS Customer Support about any problems with PC-CDU, receiver, etc., please do the following:

1. Run PC-CDU.
2. Establish the connection between PC-CDU and the receiver.
3. Click **Help**, and then click **About**, or alternatively press **CTRL+U**.
4. Click **Save to file**. Specify the name of the text file. Click **Save**. The file will be saved onto the selected computer's disk.
5. Send the file containing the logs, along with a note describing the problem you have encountered, to JNS Customer Support using either the pccdu@javad.com or support@javad.com e-mail address.

Appendix A. PC-CDU Scripts

Introduction to PC-CDU scripts

Script is a plain text file each line of which is either a receiver command, or a PC-CDU command, or a comment. It can be created and edited with a text editor, e.g. Notepad. You can also edit an existing script in the **Manual Mode** window.

To create a new script or edit an existing one in Manual Mode, follow these steps:

Create script	Edit script
1. Press the button **Edit script**	1. Press the button **Edit script**
2. Enter the name of a new script (the field **File name**)	2. Select the desired script name in the list of available scripts
3. Press the button **Open**	3.Press the button **Open**
4. Type your script	4. Make necessary changes in the script
5. Press the button **Save script**	5. Press the button **Save script**
	6. Finally, press the button **Close editor**

It is recommended to save scripts using the extension **.jpc**.

To run a script through the command line of the Manual Mode window:

First, enter the script name with the character '@', which is followed by the script name.

Next, specify necessary script arguments, if required.

Finally, press the **Send command** button.

Script arguments should be delimited by either spaces or commas. If some of the arguments in the command line contain separators (spaces and/or commas), put such arguments into double quotes ("), e.g.: @myscript "This is one argument" these are 4 arguments.

Alternatively, instead of typing the script name, you may use the **Load script** button, which allows you to select the required script from the **Script file** window.

For easy access to scripts, it is recommended to keep them all in one directory, e.g. in PC-CDU's working directory.

After PC-CDU starts script execution, it will read the file line by line carrying out the following operations, if necessary:

- skipping empty and comment lines;
- replacing variables with their specific values;

- echoing non-empty lines to the screen (if echo is enabled);
- interpreting PC-CDU internal commands, and;
- sending commands to the receiver and (optionally) waiting for receiver replies.

To abort the script execution, click the **Stop script** button.

Variables

Variables are special character sequences that are substituted for some specific values[22] while running the script. Currently PC-CDU supports the following variables: @1, @2, … @9 и @0.

The first nine of these variables initially contain the values of the script's command line arguments. With the command **@default**, you can assign the default values to these variables unless the corresponding arguments have already been specified through the script command line. Also, you may use the **@set** command to change the variables' values.

The variable @0, which is read-only, has a special purpose. Initially it contains the script name specified in the command line. In the course of script execution, it will either contain the last of the receiver's positive acknowledgements (i.e. the most recent of the **RExxx** replies), or remain empty. After getting **RExxx** from the receiver, PC-CDU will search the received sequence for the last of the '%' symbols it contains. PC-CDU does not assign to the variable @0 the entire **RExxx** reply, but only the characters following immediately after the last '%' symbol (until the end of this sequence is found). Leading and trailing spaces are trimmed. With the **@set** command, you can assign the value of @0 to other variables.

Any line beginning with '#' (hash) is considered a comment and is ignored by PC-CDU script interpreter.

PC-CDU commands

Any line starting with the '@' character is interpreted as a PC-CDU command with optional arguments separated by commas or spaces. In table below, you will find the description of supported commands.

Table 9. List of PC-CDU commands

Command	Arguments	Description
:<label name>		Specifies a label. Label names should not contain spaces or commas. See the *goto* command for how to use labels.
call	<script name> [<arguments>]	Calls another script. The maximum number of recursive calls is 200.
clear		Clears the *manual mode* window removing from it both the issued commands and receiver replies.

[22]) specified by the user and stored by PC-CDU

<table>
<tr><td>default</td><td>variable name (@1…@9) followed by its default value</td><td>Defines the default values for those of the script arguments that were not explicitly specified in the command line.
For example,
@default @1 a
sets the variable @1 to "a" unless this argument is already defined in the command line.</td></tr>
<tr><td>disconnect</td><td></td><td>Stops script execution, disconnects PC-CDU from the receiver and closes the manual mode window. This is the same as pressing the 'Disconnect' button.</td></tr>
<tr><td>echo</td><td>on
off
any character sequence</td><td>Turns echo on and off, or displays its arguments.
If echo is turned on, PC-CDU will be displaying all non-empty lines entered in the script, specifically, PC-CDU commands, receiver commands and the corresponding reply messages. If echo is turned off, PC-CDU will be displaying only replay messages preceding them with the '>' character. PC-CDU will not show @echo off and @echo on commands. Default is 'on'.</td></tr>
<tr><td>exit</td><td></td><td>Stops script execution, disconnects PC-CDU from the receiver and exists PC-CDU.</td></tr>
<tr><td>goto</td><td><label name></td><td>Jumps to the line following immediately after @:<label name>
If PC-CDU can't find such a label in the script, this command is just ignored and PC_CDU continues with the script.</td></tr>
<tr><td>send</td><td><bytes to send></td><td>Sends the argument to the receiver as is, without making any substitutions. This string may contain escape sequences in a C-like style to represent non-printable characters:
<table>
<tr><th>Sequence</th><th>Value</th><th>Character</th></tr>
<tr><td>\a</td><td>0x07</td><td>BEL</td></tr>
<tr><td>\b</td><td>0x08</td><td>BS</td></tr>
<tr><td>\f</td><td>0x0C</td><td>FF</td></tr>
<tr><td>\n</td><td>0x0A</td><td>LF</td></tr>
<tr><td>\r</td><td>0x0D</td><td>CR</td></tr>
<tr><td>\t</td><td>0x09</td><td>HT</td></tr>
<tr><td>\v</td><td>0x0B</td><td>VT</td></tr>
<tr><td>\\</td><td>0x5C</td><td>Backslash</td></tr>
<tr><td>\"</td><td>0x22</td><td>Double quote</td></tr>
<tr><td>\O</td><td>any</td><td>O - octal character code</td></tr>
<tr><td>\xH</td><td>any</td><td>H - hexadecimal character code</td></tr>
</table>
With this command, you can send <u>any</u> bytes to the receiver.
Example:
@send "#OFF#\r\n"</td></tr>
<tr><td>set</td><td>1) rate <new baud rate>
2) rtscts [on,off]
3) <variable> <value></td><td>With these commands, you can handle both serial ports' parameters and PC-CDU's internal variables.
Example 1:
Suppose you have a script with the commands
….
@set @1 "a text"
@echo @1
….
When the script interpreter reaches the two commands, you will get the following reply:
>a text
Example 2:
Assign the current terminal's baud rate to @2:
%%print,/par/cur/term/rate
@set @2 @0</td></tr>
<tr><td>sleep</td><td>integer number of milliseconds</td><td>PC-CDU interrupts script execution for specified time interval.</td></tr>
</table>

stop		Stops script execution.
stoponerrors	on off	Enables/disables PC-CDU' *stop-on-error* option. This indicates whether PC-CDU will stop script execution after getting an ERxxx message from the receiver. Default is 'on'.
timeout	integer value in milliseconds, default is 5000	If a receiver command starts with a '%' symbol, PC-CDU will wait for the receiver to reply within the specified 'timeout' interval. If a reply is received during this time, it will be saved to the variable **@0**. If no reply is received over the timeout interval, or if after receiving a few bytes PC-CDU gets no more data for 100+ milliseconds, or if PC-CDU keeps receiving "continuous data" for more than 100 milliseconds, **@0** will be undefined (however, script execution will continue). In this you may need to adjust the timeout interval to be sure that the variable **@0** contains correct information.

Receiver commands

In scripts you can specify receiver commands' arguments either explicitly or through variables. When you use variables for this purpose, these will be substituted by PC-CDU for some specific values before sending the corresponding command to the receiver. If you send a receiver command that starts with '%' (command label), PC-CDU will wait for the receiver to reply and, if a reply is received, it will save the reply to the variable @0.

Currently the character '@' is used in GRIL commands only to delimit the command checksum. It should not cause any problems since PC-CDU automatically adds a checksum for every command sent to the receiver.

PC-CDU *does not interpret* receiver commands. Therefore, if you use receiver commands that change the baud rate and/or handshaking for the current receiver port (that is the port to which PC-CDU is connected), you should either use appropriate **@set** commands immediately after them, as shown below:

%%set,/par/cur/term/rtscts,off (this governs the receiver port)
@set rtscts,off (this governs the computer port)
%%set,/par/cur/term/rate,9600 (this governs the receiver port)
@set rate,9600 (this governs the computer port),

or specify such receiver commands at the end of the script, immediately before **@disconnect** or **@exit**. Otherwise, PC-CDU may be locked up waiting for the receiver to reply.

Below you will find some examples illustrating various applications of scripts.

The following script serves the purpose described in the article "Using the Coast Guard Beacon for Differential Corrections".

```
@default @1,c
%%set,dev/ser/@1/imode,rtcm
%%set,dev/ser/@1/rate,9600
%%set,/par/pos/mode/cur,cd
%%em,,/msg/nmea/GGA:1
@exit
```

After you save these lines to a file (let's say, **beacon.jpc**), you then can type in the command line: **@beacon** and press **Enter** to instruct the receiver to input RTCM corrections from serial

port C and output NMEA messages to the current terminal. If you want to use serial port B for inputting corrections, type **@beacon b** and press **Enter**.

The following example illustrates how the **goto** command and labels are used in scripts intended for work with different receiver models.

```
%/par/rcv/model%print,/par/rcv/model
@goto ls@0
@echo Unknown receiver model.
@stop
@:lsOdyssey
@echo Receiver is Odyssey!
@goto end
@:lsLegacy
@echo Receiver is Legacy!
@goto end
@:lsEurocard
@echo Receiver is Eurocard!
@:end
@stop
```

Running scripts from Windows Explorer

Files with the extension **.jpc** are automatically associated with PC-CDU. It means that you can launch PC-CDU (specifically in **Manual mode**) by clicking on a script in the file/directory tree. It can be achieved with the use of Windows Explorer, My Computer or some other Windows file manager. After the **Connection Parameters** dialog box pops up, you press the **Connect** button to open PC-CDU's **Manual Mode** window. Note, however, that the script you selected will not start automatically so that you should type the name of desired script in the command line or select the script through the **Load script** button. After exiting manual mode, you can continue working with PC-CDU in the usual way.

Appendix B. Output Period Setup Wizard

The Output Period Setup Wizard is a feature that helps you select and set the correct values for generating raw data and updating the receiver position.

PC-CDU will open this Wizard only if you try to specify an incorrect recording interval. Once the Wizard is run, follow the onscreen instructions to adjust the typed values.

The following five figures, which are given here just for your convenience, show how the Output Period Setup Wizard windows look. These windows are listed in order of appearance.

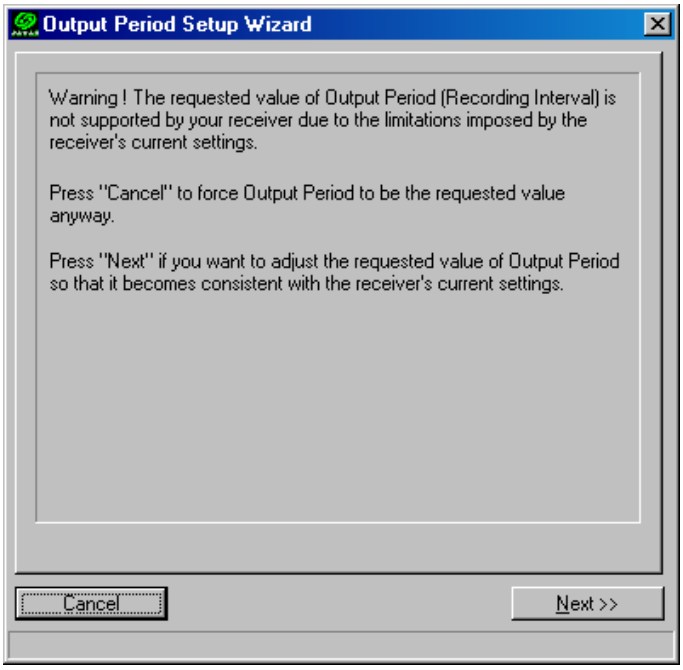

Output Period Setup Wizard
Warning ! The requested value of Output Period (Recording Interval) is not supported by your receiver due to the limitations imposed by the receiver's current settings.
Press "Cancel" to force Output Period to be the requested value anyway.
Press "Next" if you want to adjust the requested value of Output Period so that it becomes consistent with the receiver's current settings.
Cancel
Next >>

Figure 59. Wizard's 1st window

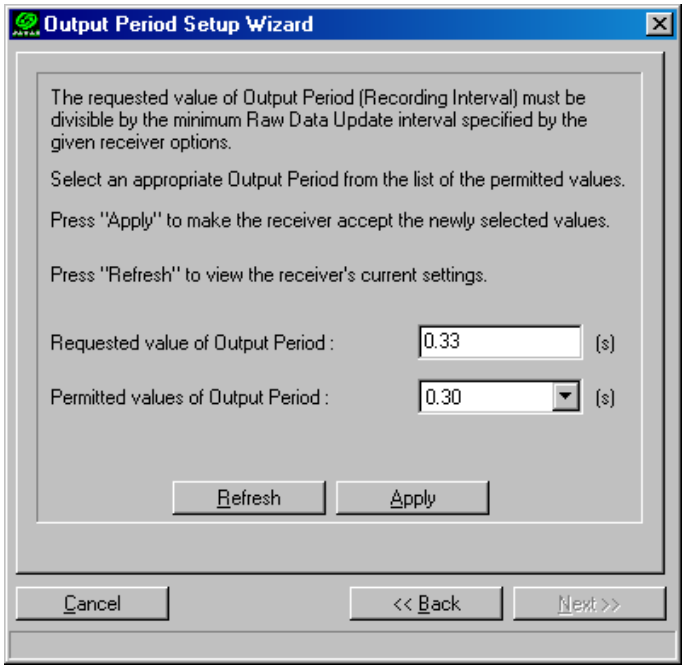

Output Period Setup Wizard
The requested value of Output Period (Recording Interval) must be divisible by the minimum Raw Data Update interval specified by the given receiver options.
Select an appropriate Output Period from the list of the permitted values.
Press "Apply" to make the receiver accept the newly selected values.
Press "Refresh" to view the receiver's current settings.
Requested value of Output Period :
0.33
(s)
Permitted values of Output Period :
0.30
(s)
Refresh
Apply
Cancel
<< Back
Next >>

Figure 60. Wizard's 2nd window

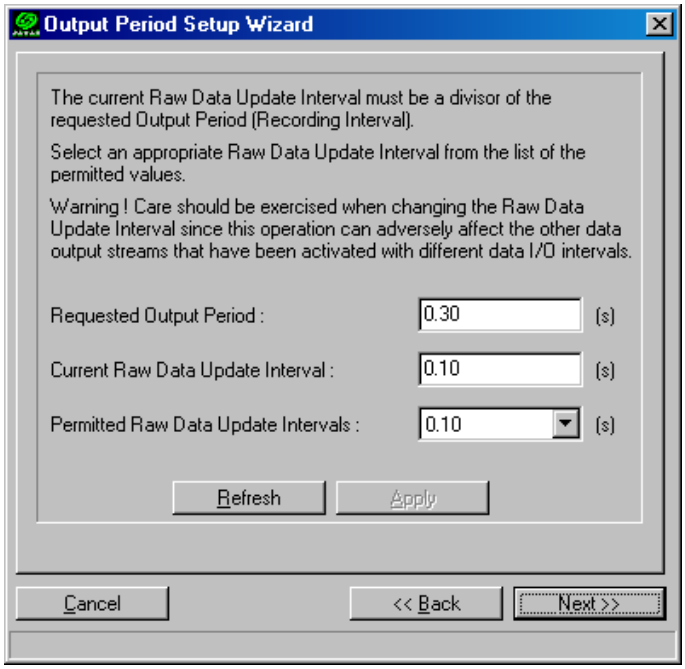

Output Period Setup Wizard
The current Raw Data Update Interval must be a divisor of the requested Output Period (Recording Interval).
Select an appropriate Raw Data Update Interval from the list of the permitted values.
Warning ! Care should be exercised when changing the Raw Data Update Interval since this operation can adversely affect the other data output streams that have been activated with different data I/O intervals.
Requested Output Period :
0.30
(s)
Current Raw Data Update Interval :
0.10
(s)
Permitted Raw Data Update Intervals :
0.10
(s)
Refresh
Apply
Cancel
<< Back
Next >>

Figure 61. Wizard's 3rd window

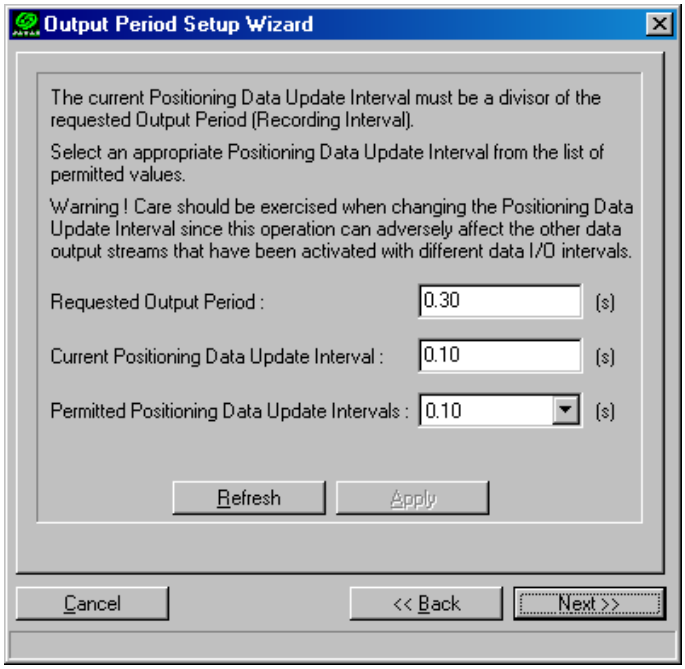

Output Period Setup Wizard
The current Positioning Data Update Interval must be a divisor of the requested Output Period (Recording Interval).
Select an appropriate Positioning Data Update Interval from the list of permitted values.
Warning ! Care should be exercised when changing the Positioning Data Update Interval since this operation can adversely affect the other data output streams that have been activated with different data I/O intervals.
Requested Output Period :
0.30
(s)
Current Positioning Data Update Interval :
0.10
(s)
Permitted Positioning Data Update Intervals :
0.10
(s)
Refresh
Apply
Cancel
<< Back
Next >>

Figure 62. Wizard's 4th window

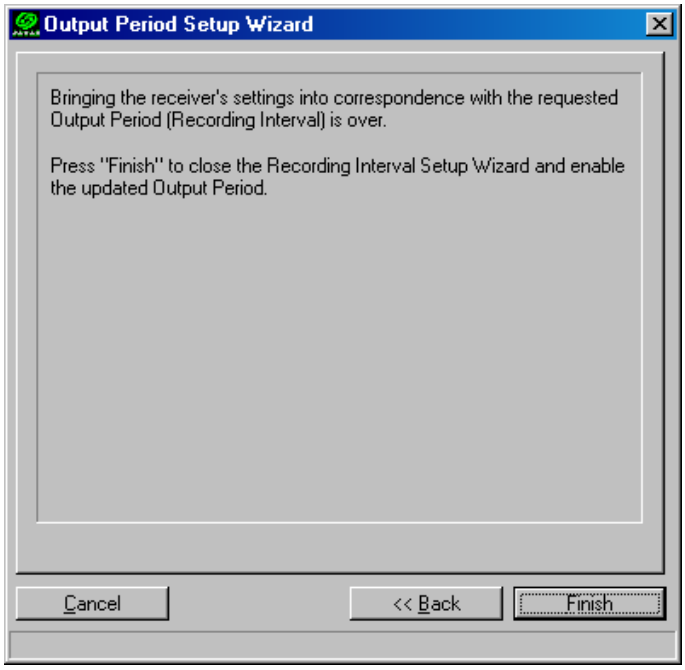

Output Period Setup Wizard
Bringing the receiver's settings into correspondence with the requested Output Period (Recording Interval) is over.
Press "Finish" to close the Recording Interval Setup Wizard and enable the updated Output Period.
Cancel
<< Back
Finish

Figure 63. Wizard's 5th window

Appendix C. Channel Navigation Status Codes

Code	Meaning
00	C/A data used for position computation
01	P1 data used for position computation
02	P2 data used for position computation
03	Ionosphere-free combination used for position computation
04	Measurements are not available
05	Ephemeris is not available
06	Unhealthy SV [as follows from operational (=ephemeris) SV health]
07	Time-Frequency parameters from the ephemeris data set may be wrong [2]
08	Initial conditions (position and velocity vectors) from the ephemeris data set may be wrong [2]
09	Almanac SV health indicator is not available for this satellite [2]
10	Unhealthy SV [as follows from the almanac SV health indicator] [2]
11	"Alert" flag (from the word "HOW") is set [1]
12	URA indicates the absence of accuracy prediction for this SV [1]
13	This SV is excluded from position computation by the user
14	SV with this frequency channel number is excluded from position computation by the user [2]
15	This SV is excluded from solution since its system number is unknown [2]
16	This SV has elevation lower than the specified mask angle
17	Reserved
18	Ephemeris data is too old
19	This SV does not belong to the constellation the user has selected
20	Differential data from Base Station are not available for given satellite (this field is meaningful only when receiver runs in DGPS)
21	Reserved
22	Wrong measurements have been detected by RAIM
23	SNR below specified minimum level
24, 25	Reserved
26	Reserved
27	DLL is not settled
28	Ionospheric corrections are not received from base
29	Coarse code outlier has been detected
30	Reserved
31	SV is not used in RTK processing. It is similar to code 20 but is used specifically for RTK.
32-50	The same as 30

51	Reserved
52	C/A slot is used in RTK processing
53	P L1 slot is used in RTK processing
54	P L2 slot is used in RTK processing
55	P L1 & P L2 measurements are used in RTK processing
56-62	C/A & P L2 measurements are used in RTK processing
63	Reserved

1 GPS only

2 GLONASS only

Codes 0-3 and 45-62 will show for the given satellite which raw data measurements have been used in position computation. The rest codes will indicate why this satellite has been excluded from position computation.